CrossCheck® GPRS 1900

Installation Manual

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Trimble®

Corporate Office

Trimble Navigation Limited
645 North Mary Avenue
Post Office Box 3642
Sunnyvale, CA 94088-3642
U.S.A.
Phone: 1-408-481-8940, 1-800-545-7762
www.trimble.com

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This is the January 2004 release (Revision B) of the *CrossCheck GPRS Installation Manual*, part number 47770-00-ENG. Use this manual with the Echo*LDX Message Terminal Installation and User's Manual*, part number 46667-00-ENG, Revision B, July 2002. For Ready Mix customers, use this manual in conjunction with the *Telvisant Ready Mix Sensor Installation Guide*, part number 46667-10-ENG, Revision E, May 2003.

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Notices

Class B Statement – Notice to Users. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.

CrossCheck GPRS 1900

CE

The CrossCheck GPRS 1900 product complies with the essential requirements of the R&TTE Directive 199/5EC as stated by the EC Declaration of Conformity (CE0681) and the EC R&TTE Type Examination Certificate.

FCC

The CrossCheck GPRS 1900 product complies with the FCC Part 15 and FCC Part 24, and Industry Canada requirements.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

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About this Manual

Welcome to the *CrossCheck GPRS 1900 Installation Manual*. This manual describes how to install and operate the CrossCheck® GPRS 1900 mobile unit.

Note – *The CrossCheck GPRS 1900 mobile unit does not support the TAIP protocol, or the* IQ*EventEngine™ firmware that is used by some CrossCheck products.*

Even if you have used other Global Positioning System (GPS) products before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product.

If you are not familiar with GPS, visit Trimble's website (www.trimble.com) for an interactive look at Trimble and GPS.

Trimble assumes that you know how to use a mouse, select options from menus, and make selections from lists.

Related Information

This manual is available in portable document format (PDF) from the Trimble website at www.trimble.com/support.

Use this manual with the *EchoLDX Message Terminal Installation and User's Manual* (PN 46667-00-ENG).

For Ready Mix customers use this manual in conjunction with the *Telvisant Ready Mix Sensor Installation Guide (*PN 46667-10-ENG, Revision E, May 2003).

Other sources of related information are:

- The Fleet Management and Mobile Resource Management section of the Trimble website contains useful information about Telvisant services and products. Go to www.trimble.com/vehtrack.html.
- For more information about CrossCheck GPRS 1900 mobile unit, go to the Trimble website at www.trimble.com/crosscheckgprs.html.

Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, *contact your local dealer* for technical assistance.

Prospective dealers (not under contract) may get general information about the CrossCheck GPRS 1900 by:

- e-mailing sales_info@trimble.com
- visiting the Trimble website at www.trimble.com/telvisant

Existing dealers may obtain additional information about the CrossCheck GPRS 1900 by:

- e-mailing trimble_support@trimble.com
- contacting their local sales office or sales engineer
- visiting the Trimble Partners website at partners.trimble.com

Your Comments

Your feedback about the supporting documentation helps us to improve it with each revision. To forward your comments, send an e-mail to ReaderFeedback@trimble.com.

Abbreviations

The following abbreviations are used in this manual:

Abbreviation	Definition
AVL	Automatic Vehicle Location
CrossCheck, CrossCheck GPRS, CrossCheck GPRS unit	The CrossCheck GPRS 1900 mobile unit
Echo*LDX*	The Echo*LDX* Message Terminal
GPRS	General Packet Radio Service, a packet-based wireless communication service
GPS	Global Positioning System
MDT	Mobile Data Terminal
Mobile Data Terminal	The Echo*LDX* Message Terminal
OTA	over the air
SIM	Subscriber Identity Module
TMS	Trimble Mobile Solutions, a division of Trimble Navigation Limited
TWG	Telvisant™ Wireless Gateway

CHAPTER

1

Overview

In this chapter:

- Introduction
- CrossCheck GPRS 1900 Mobile Unit
- CrossCheck GPRS Applications
- The Global Positioning System
- GPS Receiver

Introduction

This manual describes the CrossCheck GPRS 1900 mobile unit. The CrossCheck GPRS unit is designed to be used with Trimble's Telvisant Wireless Gateway (TWG) for fleet asset management and Automatic Vehicle Location (AVL).

The CrossCheck GPRS unit runs the firmware necessary to communicate with the TWG. The CrossCheck GPRS firmware:

- automatically reports location-based information such as position, speed, and direction
- sends alerts when the vehicle stops or exceeds a specified speed
- provides information such as vehicle run time and mileage
- provides information such as sensor feedback (if installed)

The TWG can program the CrossCheck GPRS unit over the air (OTA). You can request OTA programming to change configuration parameters or the entire code set.

CrossCheck GPRS 1900 Mobile Unit

The CrossCheck GPRS 1900 mobile unit is a mobile communications system module for Automatic Vehicle Location (AVL) and fleet asset management applications. It operates over the GPRS cellular network and allows simple, fast, and efficient transfer of information between a vehicle and the Telvisant Web-based gateway.

The CrossCheck GPRS unit integrates the following into a single, compact housing:

- A GPRS 900/1900 MHz cellular transceiver module
- A high-sensitivity, 8-channel GPS receiver
- A controller that features the proprietary firmware and integrated datalogging functions

The CrossCheck GPRS unit automatically reports arrival at or departure from an area that has been defined by a Site Dispatching message. The area may be either a new Job Site to be attended, or the Home Site (Base). CrossCheck GPRS unit also allows various asset utilization calculations.

Standard features

Note – *The features and functions of this product are* ***not*** *identical to the features and functions of other products in the CrossCheck family, such as the CrossCheck AMPS, CrossCheck GSM, and CrossCheck XR.*

The CrossCheck GPRS unit includes the following standard features:

- A sophisticated event handler for OTA configuration
- One serial port for messaging communication with the optional Echo*LDX* Message Terminal (PN 46722-00)
- discrete inputs, pulse counters, and outputs for vehicle peripheral support

- Configurable Zone Logic Configuration packet:
  - Geo-fence area for Job Sites
  - Geo-fence area for Home Sites
  - Entry and exit speed limits for Site Dispatch purposes
  - Site dispatch time out
  - Minimum duration to detect entry/exit regions
- Storage of events and positions for up to one week while the CrossCheck GPRS is out of the coverage area

Note – *The CrossCheck GPRS 1900 does not support the TAIP protocol, or the* IQ*EventEngine firmware that is used by some CrossCheck products.*

Optional system components

The Echo*LDX*™ Message Terminal is available as an optional system component. The Message Terminal is the messaging user interface in a fleet asset management system. It displays Text Messages, Job Sites, and Home Sites that the Telvisant Wireless Gateway sends to the CrossCheck GPRS unit.

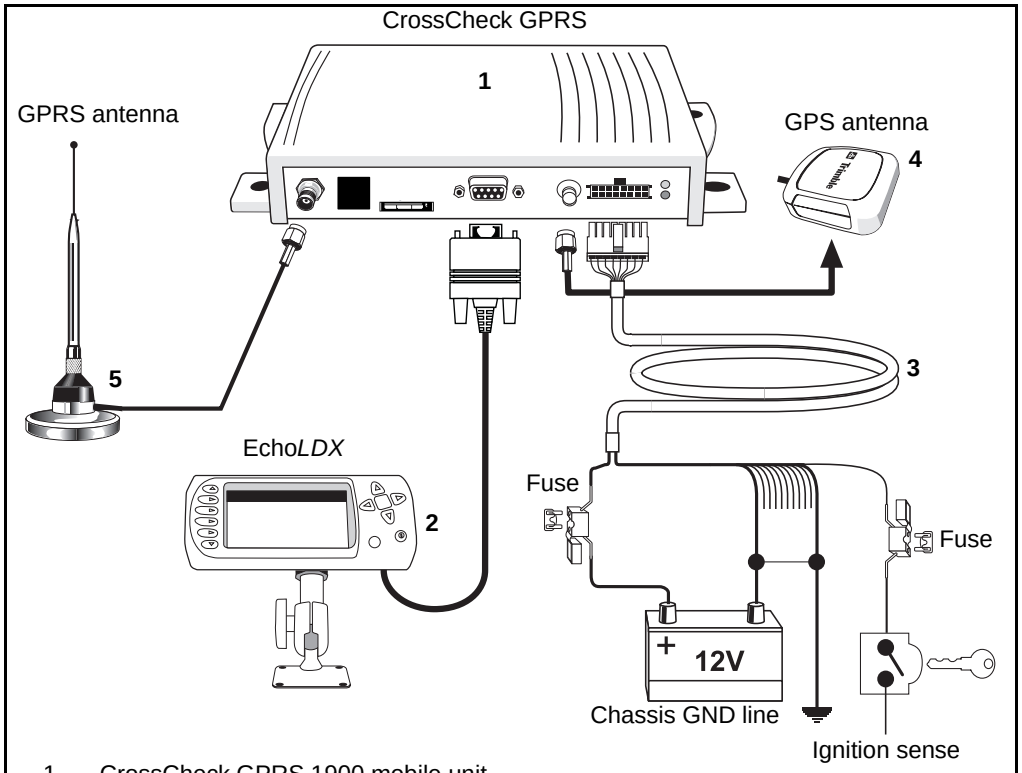
Antenna requirements

To operate correctly, the CrossCheck GPRS unit must be connected to a GPRS antenna and to a GPS antenna. Because the type of antenna required depends on the application and installation location, the standard CrossCheck GPRS system does not include antennas. Trimble manufactures both bulkhead and magnetic mount GPRS and GPS antennas for use with a CrossCheck GPRS unit. These antennas must be ordered separately.

For information on the antennas that are available from Trimble, and their installation, see Chapter 2, Installation. For ordering information, see Appendix A, Specifications.

CrossCheck GPRS system components

Figure 1.1 shows the components of a CrossCheck GPRS system.



1 CrossCheck GPRS 1900 mobile unit

2 Optional Echo*LDX* Message Terminal kit:

- Echo*LDX* Message Terminal
- Echo*LDX* power/data cable
- Pedestal mounting kit
- Echo*LDX Quick Reference Guide* (not shown)

3 Power and discrete I/O cable

4 GPS antenna with cable and SMA-p connector

5 GPRS antenna with cable and TNC-p connector

Figure 1.1 CrossCheck GPRS system components

CrossCheck GPRS Applications

The Trimble Mobile Solutions (TMS) division provides a set of core products, around which you can build systems and applications for managing your transport and logistics assets.

TMS products and services provide the building blocks at both ends of the asset management system, including the on-board units mounted in the vehicle and the Telvisant Web-based gateway for dispatch and control applications.

The central on-board component is the CrossCheck GPRS unit. You can use the unit as a standalone unit, or interface it with external accessories and sensors to make it function as part of an on-board system.

The optional Echo*LDX* Message Terminal provides a driver interface for exchanging messages and generating event reports.

The CrossCheck GPRS and applications can do the following:

- Automate vehicle status changes for dispatching applications.
- Determine time spent and distance traveled on jobs for accounts-payable systems.
- Improve efficiency by detecting unauthorized vehicle stops or off-route activities.
- Improve customer service by advising customer service systems of delays.
- Drive compliance by keeping a time-stamped log of activities.
- Improve safety by indicating speed limit violations.
- Identify unauthorized use of equipment and detect theft.

The Global Positioning System

The Global Positioning System (GPS) is a satellite-based navigation system operated and maintained by the U.S. Department of Defense. GPS consists of a constellation of 24 satellites providing world-wide, 24-hour, three-dimensional (3D) coverage. Although originally conceived for military needs, GPS has a broad array of civilian applications including timing, surveying, fleet management, marine, land, aviation, and vehicle navigation. As a satellite-based system, GPS is free from the limitations of land-based systems, which have limited coverage and whose accuracy varies with geographic location.

A GPS receiver calculates an accurate position by computing its distance from GPS satellites orbiting the earth. This process is called satellite ranging. A GPS receiver can also provide precise time, speed, and course measurements, which are important for vehicle mobile positioning and communications applications.

GPS Receiver

The CrossCheck GPRS unit includes an advanced GPS receiver, which provides the position, course, speed, and time information required for AVL and fleet management applications.

The integrated GPS receiver in the CrossCheck GPRS unit features an eight-channel digital signal processor which operates at the GPS L1 frequency (1575.42 MHz) and processes the Coarse/Acquisition (C/A) code portion of the GPS signal. The RF and digital signal-processing components of the GPS module are custom integrated circuits designed by Trimble.

CHAPTER

2

Installation

In this chapter:

- Introduction
- CrossCheck GPRS Connectors and Ports
- Inspecting and Unpacking the Shipment
- Installer-Supplied Parts
- Installing the CrossCheck GPRS Unit
- Installing the GPS Antenna
- Installing the GPRS Cellular Antenna
- CrossCheck GPRS Power
- Other Connections

Introduction

This chapter provides instructions for installing the CrossCheck GPRS 1900 mobile unit in a vehicle.

Caution – The CrossCheck GPRS unit and its antennas and accessories should only be professionally installed by Trimble Authorized dealers.

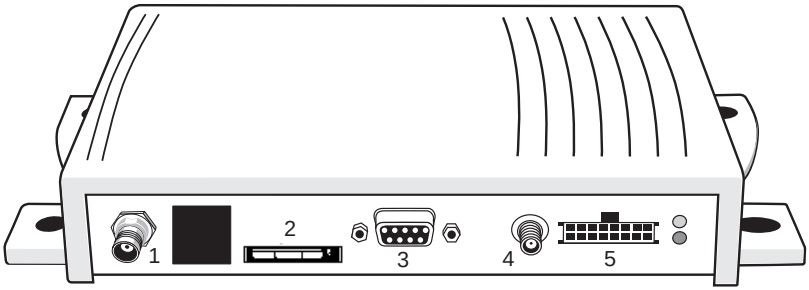
Caution – To satisfy the FCC RF exposure requirements, a minimum separation distance of 20 cm must be maintained between the antenna and the operator. The maximum antenna gain, including any cable loss, must not exceed 3 dBi. If the antenna is installed close to another antenna, then the requirements of Section 1.1307 (b) (3) of the FCC rules (antenna co-location) must be satisfied.

Caution – The CrossCheck GPRS unit is designed for vehicle-mounted operation only. Do not use it for portable operation.

Note – *If you install the CrossCheck GPRS unit before you install the EchoLDX terminal, make sure that you allow adequate clearance between the two components. Leave enough room to connect the CrossCheck GPRS to the EchoLDX terminal, and make sure that the LED indicators on the CrossCheck GPRS are visible for troubleshooting.*

CrossCheck GPRS Connectors and Ports

Figure 2.1 shows the connectors and ports on the CrossCheck GPRS unit.



1. GPRS cellular antenna connector (TNC receptacle)
2. SIM Slot
3. Message Terminal port (DB9 receptacle)
4. GPS antenna connector (SMA receptacle)
5. Power and discrete I/O

Figure 2.1 CrossCheck GPRS unit ports and connectors

GPRS antenna connector

The CrossCheck GPRS unit has a TNC receptacle connector for connecting to the GPRS antenna. For more information, see Appendix A, Specifications.

SIM slot

The SIM, or Subscriber Identity Module, is an electronic card that identifies the CrossCheck GPRS unit to the GPRS network. The SIM card is stored in the SIM slot.

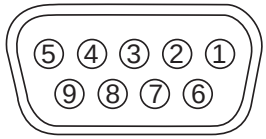
Caution – Do not remove the SIM card from the CrossCheck GPRS unit. The SIM card only works with the CrossCheck GPRS unit, and cannot be used with any other GPRS phone.

GPS antenna connector

The CrossCheck GPRS unit has an SMA receptacle (SMA-r) for connecting to the GPS antenna. For more information, see Appendix A, Specifications.

Message Terminal port

The Message Terminal port is a serial port for messaging communication with the optional Echo*LDX* Message Terminal. Figure 2.2 shows the Message Terminal port pin configuration, a standard 9-pin DCE configuration.

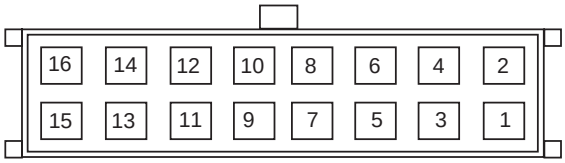


Pin	Signal	Direction	Connection
1	DCD	Output	Carrier Detect
2	RxD	Output	Serial Data
3	TxD	Input	Serial Data
4	DTR	Input	Data Terminal Ready
5	GND		Ground
6	DSR	Output	Data Set Ready
7	RTS	Input	Request to Send
8	CTS	Output	Clear to Send
9	PWR	Output	Power: 12 V DC @ 150 mA maximum (Interpreted as RS-232 high-level)

Figure 2.2 Pin configuration and pinouts for the Message Terminal port

Power and discrete I/O port

Figure 2.3 shows the pin configuration for the power and I/O port.



Pin	Signal	Direction	Function
1	V_{batt}	Input	Power: 9–32 V
2	GND		Battery Ground
3	CHAS		Chassis Ground
4	GND		Ground
5	IGN	Input	Ignition Sense
6	IP3	Input	Discrete Input 3
7	IP2	Input	Discrete Input 2
8	XP2	Output	Discrete Output 2
9	IP1	Input	Discrete Input 1
10	XP1	Output	Discrete Output 1
11	IP0	Input	Discrete Input 0
12	XP0	Output	Discrete Output 0
13	Pulse 0	Input	Pulse Input 0
14	Pulse 1	Input	Pulse Input 1
15	Pulse 2	Input	Pulse Input 2
16	12 V AUX	Output	12 V DC Auxiliary

Figure 2.3 Pin configuration and pinouts for power and discrete I/O port

Inspecting and Unpacking the Shipment

The CrossCheck GPRS unit may be shipped in one or more cartons, depending on the number of units and the options ordered with the shipment. The shipment may include additional cartons containing GPS and cellular antennas, interface cables, and Echo*LDX* kits.

Before opening the shipping containers, inspect the cartons for punctures or damage, and immediately report any damage to the shipping carrier. Then open the individual shipping cartons and check the contents against the packing slip.

Table 2.1 identifies the CrossCheck GPRS part numbers and the included components.

Table 2.1 CrossCheck GPRS versions

Product	Part number	Comments
CrossCheck GPRS 1900 Mobile Unit Demo Kit	46728-01	Includes: • magnetic mount GPS antenna • magnetic mount GPRS antenna • power and I/O cable with cigarette lighter adaptor • Echo*LDX* Message Terminal Kit
CrossCheck GPRS 1900 Mobile Unit	46728-11	Single units do ***not*** include a GPS antenna, GPRS antenna, or power and I/O cable. These items must be ordered separately. ***Note –*** *The part number of the CrossCheck GPRS unit depends on the type of carrier and the coverage for certain areas. To order the correct part number for your area, contact your Trimble representative.*
CrossCheck GPRS 1900 Ready Mix Mobile Unit	46728-12	
CrossCheck GPRS 1900 Heavy Vehicle Mobile Unit	46728-13	

For a complete listing of CrossCheck GPRS unit components and their part numbers, see Table A.19.

Installer-Supplied Parts

The installer must supply the following parts:

- GPS antenna, cable, and connector
- GPRS cellular antenna, cable, and connector
- Fasteners for mounting bulkhead GPS or bulkhead cellular antennas
- Cable ties for securing cables to the vehicle

Note – *A magnetic mount GPS antenna and magnetic mount GPRS antenna are included in the CrossCheck GPRS 1900 Mobile Unit Demo Kit (PN 46728-01). GPS and GPRS antennas for use with stand-alone units must be ordered separately. For more information, see Appendix A, Specifications.*

Installing the CrossCheck GPRS Unit

To install the CrossCheck GPRS unit, you must carefully choose a mounting location, mount the unit, and then ground it.

Choosing a location for the CrossCheck GPRS unit

The CrossCheck GPRS unit can be installed in any orientation. Provided the installation location adheres to the environmental specifications, it can be installed in an enclosed compartment or in a location with limited accessibility. For example, the CrossCheck GPRS unit can be installed on the floor under a seat, or on a wall behind a seat.

Caution – Do not install the CrossCheck GPRS unit inside the engine compartment, in the wheel well, or on any exterior surface of the vehicle.

The CrossCheck GPRS unit may be mounted horizontally, vertically, or in any convenient orientation.

When selecting a mounting location, consider the specifications listed in Appendix A, and avoid the following hazards:

- Direct exposure to weather
- Excessive heat (exhaust manifolds)
- Excessive cold (refrigeration units)
- High-vibration areas (engine compartment, transmission)
- Corrosive fluids and gases (acids, petroleum products)
- Direct exposure to water (the CrossCheck GPRS is not waterproof)
- Areas where there is excessive dust

Choose a location that:

- allows for convenient routing and connection of the antenna and interface cables
- has access to a power source
- allows you to see the LED indicators. During normal system operation, you do not need to see the LED indicators, but they do provide valuable information if you are troubleshooting.
- is reasonably flat. The mounting flange is designed to secure the CrossCheck GPRS unit to a flat surface.

Mounting the CrossCheck GPRS unit

The mounting flange has four holes for securing the unit to the flat surface. Use self-tapping screws or machine screws to secure the CrossCheck GPRS unit to the mounting surface.

Caution – Do not fasten the mounting screws too tightly. This can over-stress the plastic mounting surface and crack the plastic. The mounting surface can also become compressed, cracked, or deformed if you do not use washers, or if you use washers that are too big so that they tighten down on the plastic cover of the CrossCheck GPRS unit when the mounting screws are secured.

Figure 2.4 shows the mounting dimensions. The hole size leaves some allowance for holes that are drilled slightly off center from the specified dimensions.

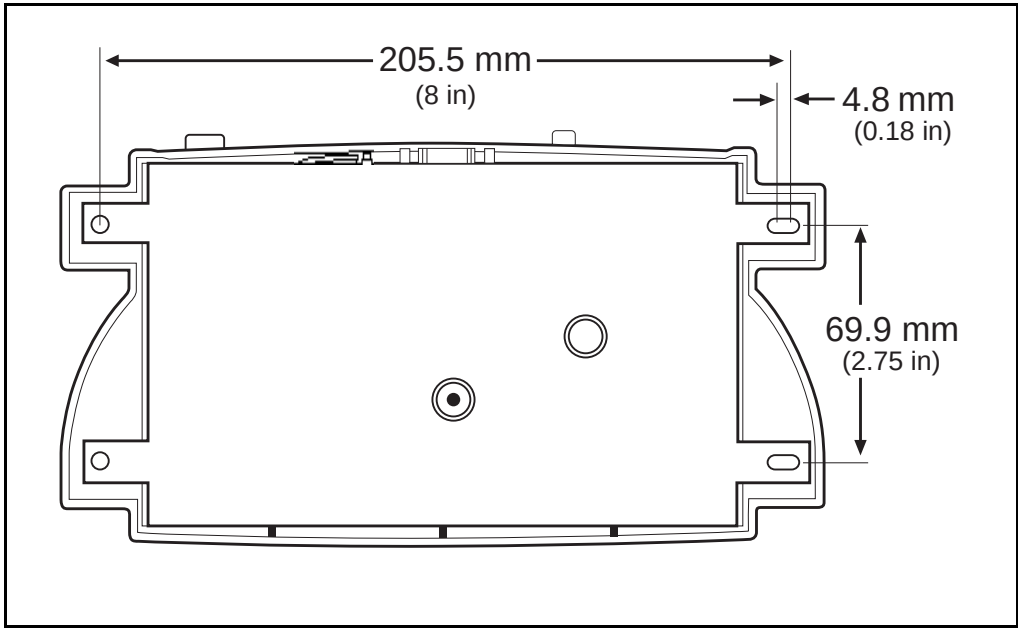


Figure 2.4 Mounting dimensions

You must provide appropriate fasteners (either self-tapping screws or machine screws) for securing the CrossCheck GPRS unit to the mounting surface.

If you use self-tapping screws, select an appropriate size and length for the mounting surface.

If you use machine screws:

- It is recommended that you use number m3.5 (or #6) pan-head machine screws.
- Select a screw that is long enough to extend a safe distance beyond the mounting surface.
- Secure the screw with a washer and a nut. It is recommended that you use lock washers to prevent the vehicle's vibration from loosening the fasteners.

Grounding the CrossCheck GPRS unit

For proper operation, the aluminum body of the CrossCheck GPRS unit must be connected electrically (grounded) to the chassis of the vehicle on which it installed. This can be accomplished in two ways:

- Direct connection through metal screws. This is the recommended method.
- Connection through the chassis ground wire.

Direct connection through mounting screws

If possible, ground the CrossCheck GPRS unit by mounting it on a metal surface that is permanently attached to the vehicle chassis. For example, mount the unit on the base of the trunk, or on a mounting plate that is permanently attached to the chassis.

Fasten the CrossCheck GPRS unit to the mounting surface using metal screws driven through the metal tabs on the sides of the unit. Use star washers to ensure a reliable electrical contact with the metal tabs.

Make sure that the screws are tight, and that they make contact both with the metal on the CrossCheck GPRS unit and with the vehicle chassis.

Note – *If you use this method to connect the CrossCheck GPRS unit to the vehicle chassis, leave the chassis ground (pin 3 on the power and discrete I/O connector) on the CrossCheck GPRS unit unconnected.*

Note – *Make sure that the vehicle chassis is properly grounded in the vehicle.*

Connection through the chassis ground wire

If the CrossCheck GPRS unit cannot be mounted directly on a metal surface when it is attached to the vehicle, then use the chassis ground wire (pin 3 on the power and discrete I/O connector) to make electrical contact with the vehicle chassis. Use a wire with gauge of at least 20 AWG to connect the CrossCheck GPRS unit power connector to the vehicle chassis. To keep the wire as short as possible, select a connection point on the vehicle chassis that is close to the CrossCheck GPRS unit. Use a metal screw with a star washer to ensure a reliable electrical contact to the vehicle chassis.

Installing the GPS Antenna

To install the GPS antenna, you must carefully choose a mounting location, mount the antenna, and then route the antenna cable to the CrossCheck GPRS.

Choosing a location for the GPS antenna

Antenna location is critical for optimum GPS performance. When choosing a location for the GPS antenna, make sure that the antenna:

- has an unobstructed view of the sky
- is safe from damage during normal vehicle operation and maintenance

- is not shielded from satellite signals by metal objects or other impenetrable materials

GPS signals can penetrate plastic, glass (including tinted glass), fiberglass, and plexiglass, provided the surface is relatively dry. GPS signals do not penetrate metal, metallized glass, or dense wood.

For optimum performance, the GPS antenna should be mounted on a metal groundplane of at least 7.5 cm square (3" × 3") only if it is not mounted on a metal surface.

If necessary, you can install the GPS antenna on a dashboard under a sloped windshield (provided the windshield is not metallized), or under a plastic fender or bumper. When the antenna is installed in one of these locations, the metal components of the vehicle shield the antenna from portions of the sky, so these alternative locations usually offer less satellite coverage.

Caution – Do not mount the GPS antenna under a metallized glass windshield, such as those used in some vehicles for window de-fogging or de-icing systems.

Disclaimer – The guidelines included in this section apply to the GPS antennas sold by Trimble and may not apply to third-party products. There are many other GPS antennas on the market, including combined GPS/cellular antenna solutions. These antennas have not been tested or certified by Trimble, and may not be compatible with the CrossCheck GPRS.

Additional guidelines to follow include:

- Mount the antenna in a horizontal position facing the sky, as shown in Figure 2.5.
- Locate the GPS antenna at least 46 cm (approximately 18") from any other antennas, such as radio or cellular phone antennas.
- Avoid areas of high vibration, such as engine hoods.

- A heavy layer of snow or ice can degrade the performance of the GPS antenna. If these are typical conditions for your application, choose an accessible mounting location, so that snow and ice can be removed easily.
- For permanent installations, choose a location that allows access both above and below the antenna mounting surface. This access is required for installing fasteners and for routing the antenna cable.
- Make sure that the antenna cable will reach from the CrossCheck GPRS unit to the antenna mounting location. The standard length of GPS antenna cables supplied by Trimble is 5 m (approximately 16 ft). You can prepare longer bulkhead-mount antenna cables using the guidelines in Appendix A, Specifications.

Figure 2.5 shows typical antenna mounting locations for a car.

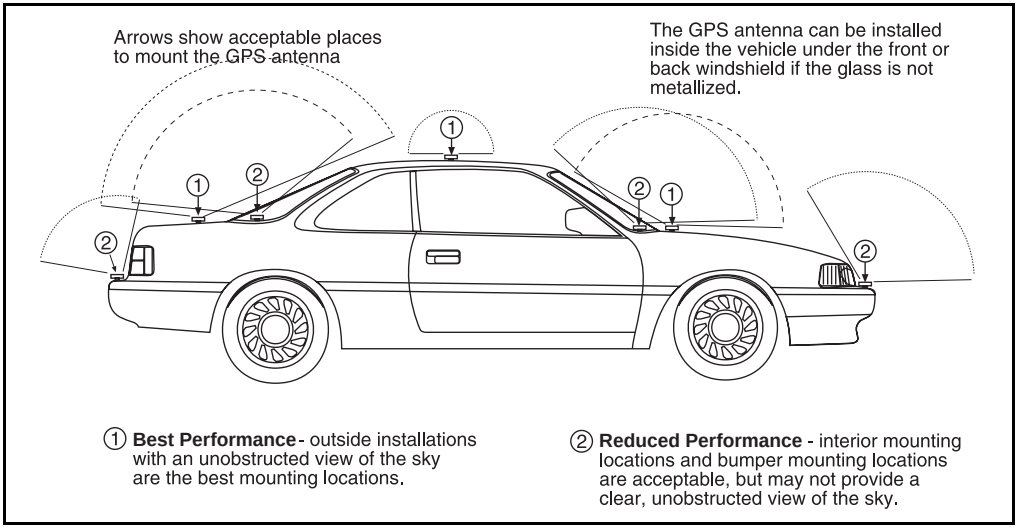

Arrows show acceptable places to mount the GPS antenna
The GPS antenna can be installed inside the vehicle under the front or back windshield if the glass is not metallized.
① **Best Performance** - outside installations with an unobstructed view of the sky are the best mounting locations.
② **Reduced Performance** - interior mounting locations and bumper mounting locations are acceptable, but may not provide a clear, unobstructed view of the sky.

Figure 2.5 Antenna mounting locations for a car

Figure 2.6 shows typical antenna mounting locations for a van.

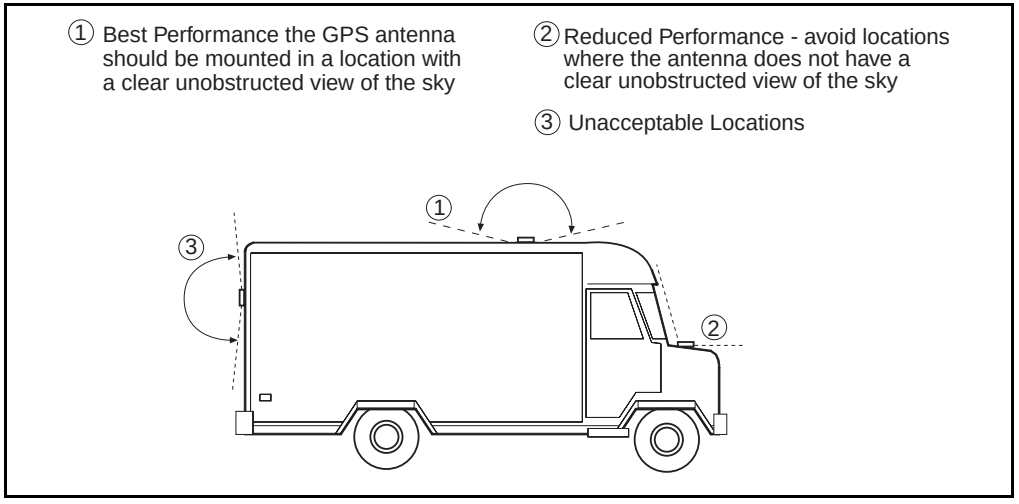

① Best Performance the GPS antenna should be mounted in a location with a clear unobstructed view of the sky
② Reduced Performance - avoid locations where the antenna does not have a clear unobstructed view of the sky
③ Unacceptable Locations
①
③
②

Figure 2.6 Antenna mounting locations for a van

You can mount the GPS antenna under a fiberglass wind deflector such as those used on conventional and cab-over trucks, as shown in Figure 2.7. Make sure that the wind deflector is not painted with a metallic finish.

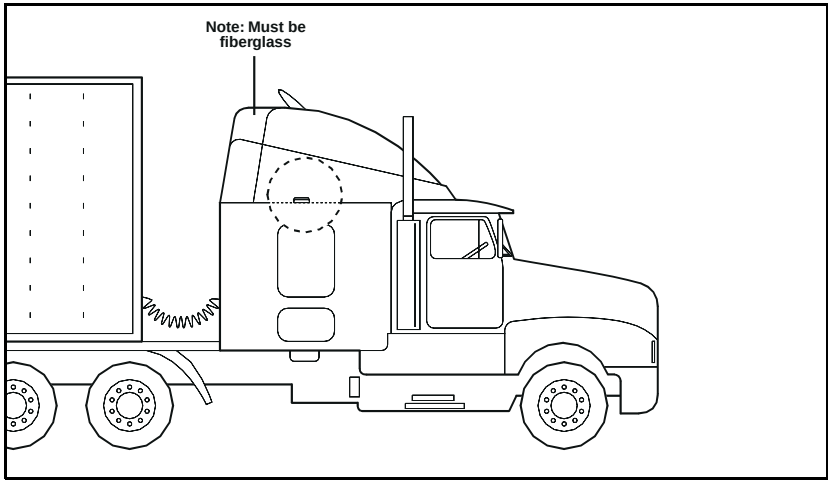


Figure 2.7 Antenna mounted under fiberglass wind deflector

Figure 2.8 shows a typical antenna mounting location for a Rear Discharge Ready Mix truck.

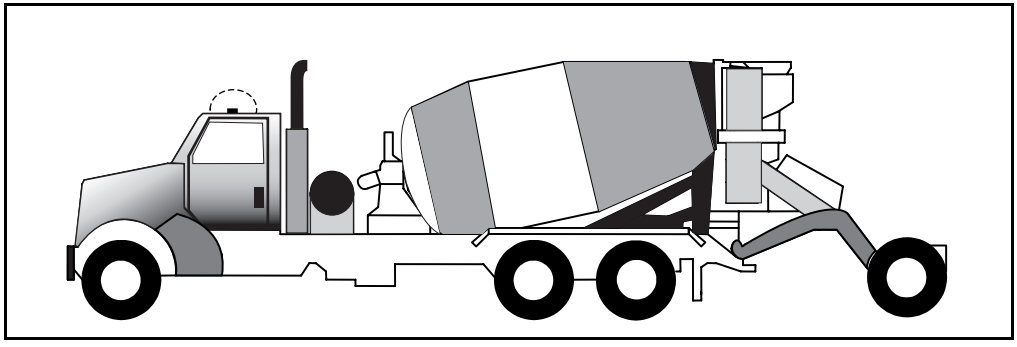


Figure 2.8 GPS antenna mounted on a Ready Mix truck

Mounting the GPS antenna

Trimble supplies three types of GPS antenna for use with the CrossCheck GPRS unit. Installation instructions for each of these three antenna types are provided below.

Mounting the miniature bulkhead GPS antenna with flange

Two cables are available for the miniature bulkhead antenna with flange (PN 31192-00):

- A straight TNC-plug-to-SMA-plug antenna cable (PN 36107)
- A right-angle TNC-plug-to-straight SMA-plug antenna cable (PN 36106)

For more information, see Appendix A, Specifications.

Figure 2.8 shows the miniature bulkhead mount GPS antenna.

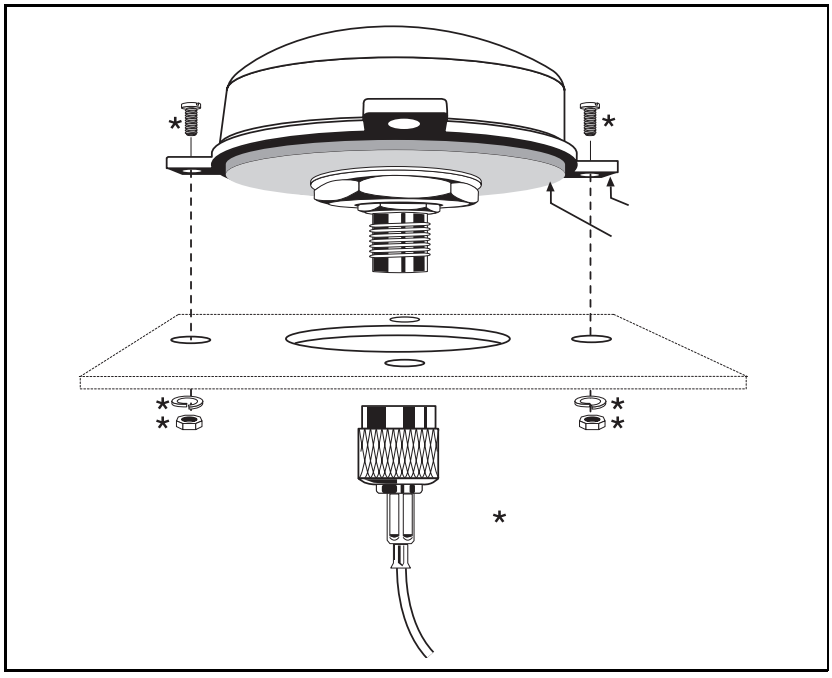


Figure 2.9 Mounting the miniature bulkhead mount GPS antenna with flange (PN 31192-00)

Note – *If you decide to keep the nut and the washer attached to the antenna, then the minimum diameter for the hole to mount it should be 5/4". If you do not want to use the nut and washer, the hole diameter can be ¾".*

To mount the miniature bulkhead mount GPS antenna with flange:

1. Drill holes in the mounting surface using the antenna mounting template shown in Figure 2.9.

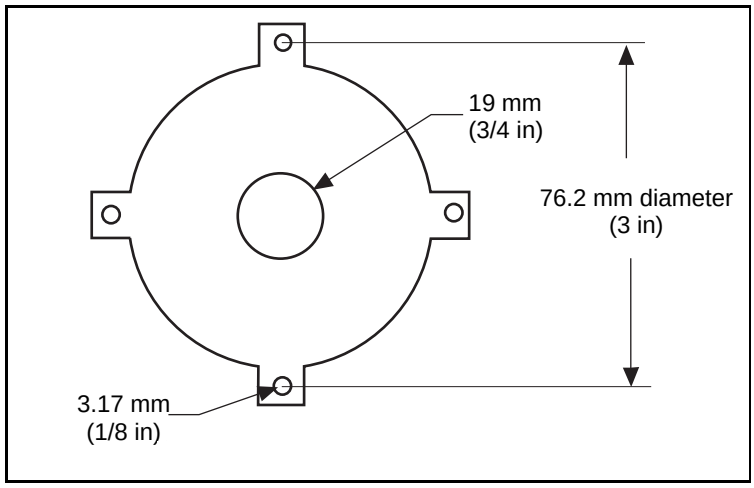


Figure 2.10 Mounting hole dimensions

2. Remove the ¾" nut (discard it if you do not need it).
3. Slip the antenna through the larger hole in the center of the hole pattern.
4. Rotate the antenna until the four holes in the antenna mounting flange are aligned with the hole circle.
5. Secure the antenna with the four screws (#6), lock washers, and nuts.
6. Connect the TNC connector on the antenna cable to the TNC connector on the antenna.
7. Route the cable to the CrossCheck GPRS unit. Use cable ties to secure the cable along the routing path.
8. Connect the cable to the GPS antenna connector.

For detailed cable routing guidelines, see Routing the GPS antenna cable, page 30.

Mounting the miniature bulkhead GPS antenna without flange

Two cables are available for the miniature bulkhead mount antenna without flange (PN 32434):

- A straight TNC-plug-to-SMA-plug antenna cable (PN 36107)
- A right-angle TNC-plug-to-straight-SMA-plug antenna cable (PN 36106)

Before drilling the mounting hole, check the metal thickness at the mounting location. The bulkhead mount on the antenna can be attached to metal surfaces with a thickness of 4.8 mm (0.188") or less.

Figure 2.11 shows the bulkhead mount GPS antenna without flange. For more information, see Appendix A, Specifications.

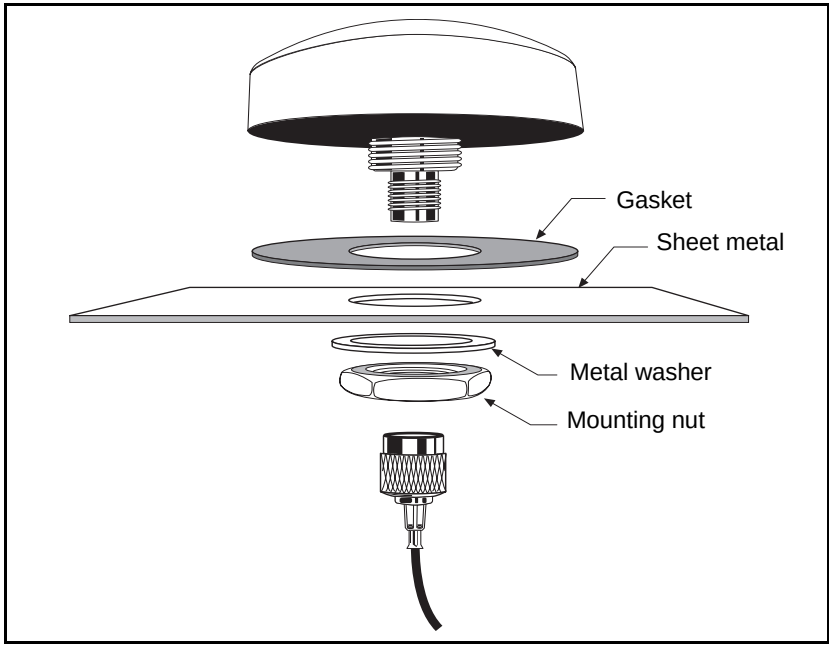


Figure 2.11 Miniature bulkhead mount GPS antenna without flange (PN 32434)

To mount the miniature bulkhead mount GPS antenna:

1. Drill a 3/4" hole at the mounting location.
2. Remove the large nut from the bottom of the antenna.
3. Mount the gasket as shown in Figure 2.11 on page 27.
4. Slip the antenna through the mounting hole and secure it using the large washer and nut.
5. Connect the antenna cable as shown in Figure 2.11.
6. Route the cable to the CrossCheck GPRS mounting location.
7. Connect the cable to the GPS antenna connector.

For detailed cable routing guidelines, see Routing the GPS antenna cable, page 30.

Mounting the miniature magnetic GPS antenna

The miniature magnetic GPS antenna (PN 37167) features a magnetic mount for attaching the unit to ferrous metal surfaces. It has an integrated 5 m (15 ft) cable with an SMA connector.

Caution – The magnetic mount antenna cable has no strain relief at the antenna end of the cable. Trimble recommends that you do not use this cable for permanent installations.

Figure 2.12 illustrates the miniature magnetic GPS antenna.

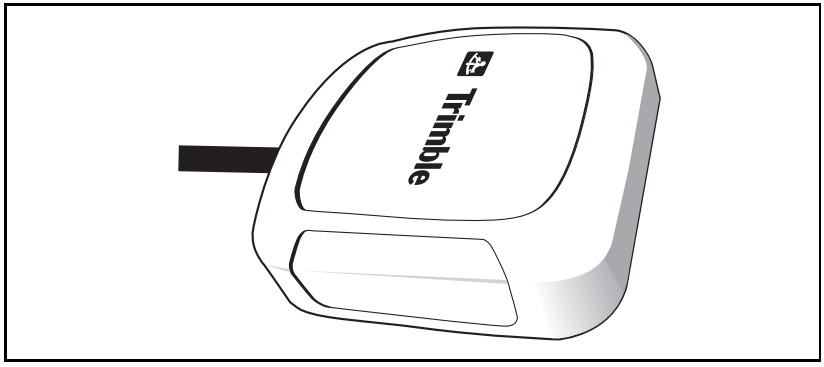


Figure 2.12 Miniature magnetic mount GPS antenna (PN 37167)

To mount the miniature magnetic GPS antenna:

1. Choose the antenna mounting location (see Choosing a location for the GPS antenna, page 19).
2. Mount the antenna to a ferrous surface.
3. Route the integrated cable to the CrossCheck GPRS mounting location. Use cable ties to secure the cable along the routing path.
4. Connect the cable to the GPS antenna connector.

For detailed cable routing guidelines, see Routing the GPS antenna cable, page 30.

Caution – Because the magnetic mount antenna cable is exposed to the environment, the cable can be damaged by wind. Use cable ties to secure the cable along the routing path.

Routing the GPS antenna cable

The magnetic GPS antenna has an integrated antenna cable, and the miniature bulkhead GPS antennas have separate cables.

If you are using a miniature bulkhead GPS antenna, attach the antenna cable to the connector on the base of the antenna before you route the cable. When routing the cable, start at the antenna and choose the most direct path to the CrossCheck GPRS unit, while observing the following guidelines:

- Make sure that there is at least 5.1 cm (2") of clearance between the CrossCheck GPRS antenna connector and the nearest obstacle.
- Make sure that the minimum radius of all cable bends is 1.3 cm (1"), especially the bend at the SMA strain relief to the antenna connector.
- Provide an adequate service loop when routing the cable around vehicle hinges, to ensure that the cable is not pinched when a hinged door opens or closes.
- Make sure that the coaxial cable is not routed through areas where vehicle movement can abrade (wear away) the cable surface.
- Never coil the excess antenna cable, particularly the magnetic GPS antenna cable. A coiled cable can act as an antenna and cause interference problems.
- Protect cables from exposure to corrosive fluids.

Once the cable is routed and secured, attach the cable to the CrossCheck GPRS GPS (SMA) connector.

Installing the GPRS Cellular Antenna

To install the GPRS antenna, you must carefully choose a mounting location, mount the antenna, and then route the antenna cable to the CrossCheck GPRS.

Caution – The CrossCheck GPRS unit and its antennas and accessories should only be professionally installed by Trimble Authorized dealers.

Caution – To satisfy the FCC RF exposure requirements, a minimum separation distance of 20 cm must be maintained between the antenna and the operator. The maximum antenna gain, including any cable loss, must not exceed 3 dBi. If the antenna is installed close to another antenna, then the requirements of Section 1.1307 (b) (3) of the FCC rules (antenna co-location) must be satisfied.

Caution – The CrossCheck GPRS unit is designed for vehicle-mounted operation only. Do not use it for portable operation.

Disclaimer – The guidelines included in this section apply to the cellular antennas sold by Trimble and may not apply to third-party products. There are many other cellular antennas on the market, including combined GPS/cellular antenna solutions. These antennas have not been tested or certified by Trimble, and may not be compatible with the CrossCheck GPRS.

Choosing a location for the GPRS cellular antenna

Mount the cellular whip antenna in a vertical orientation in a location where it is safe from damage during normal vehicle operation and maintenance. Automated vehicle washes can damage cellular antennas that have been mounted in unsuitable locations.

Maintain a separation of at least 46 cm (or approximately 18") between the cellular antenna (or any other antenna) and the GPS antenna (as illustrated in Figure 2.13). In general, the greater the separation, the less chance of interference.

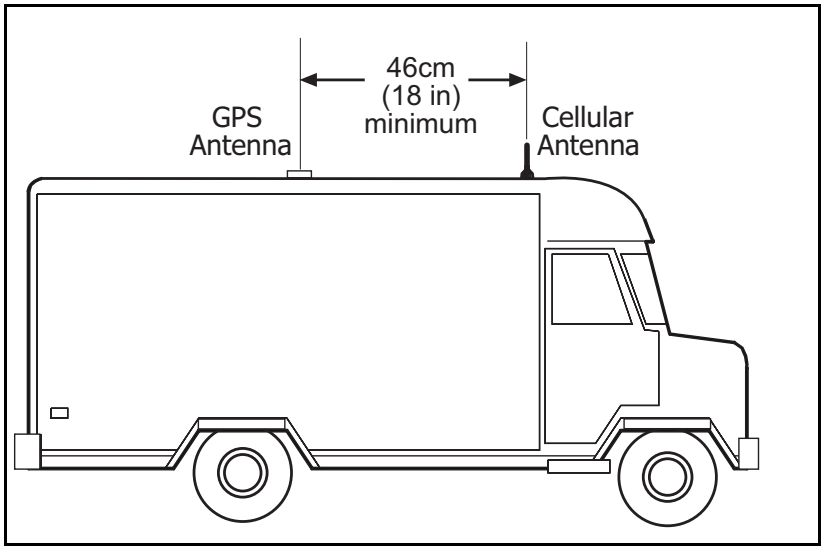


Figure 2.13 Distance between antennas

For permanent antenna installations, choose a location with access both above and below the antenna mounting surface. This access is required for installing fasteners and for routing the antenna cable.

Cellular phone dealers and installers are experts on cellular antenna placement. For some installations, the installer may substitute a glass mount antenna for the antenna supplied by Trimble. Other antennas are acceptable as long as they conform to the requirements listed in Table A.7 on page 70.

Trimble offers three cellular antenna options for the CrossCheck GPRS unit:

- The magnetic mount cellular antenna is recommended for temporary installations.
- The bulkhead mount and glass mount cellular antennas are recommended for permanent installations.

Mounting the GPRS antenna

This section provides information on mounting the GPRS antennas that are available from Trimble.

Mounting the magnetic cellular antenna

The magnetic mount 850/1900 MHz cellular antenna with magnetic base (PN 46764) is designed for temporary mounting on any ferrous surface.

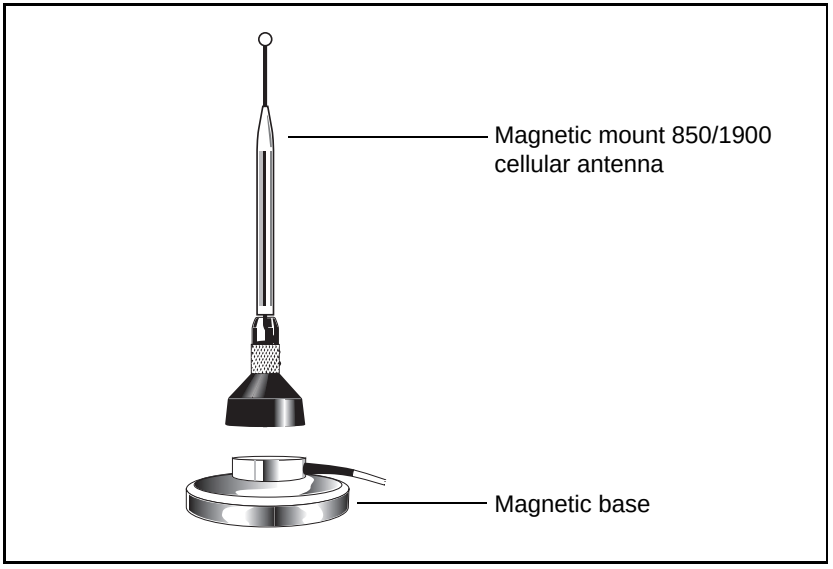


Figure 2.14 Magnetic 850/1900 MHz cellular antenna (PN 46764)

The antenna features a 3.6 m (12 ft) integrated coaxial cable. This cable is terminated with a TNC-P connector, which is compatible with the cellular antenna connector of the CrossCheck GPRS unit. The antenna has a magnetic base, which adheres to any ferrous surface without fasteners or mounting hardware.

To mount the magnetic 850/1900 MHz cellular antenna:

1. Select an appropriate location to mount the antenna. The center of the vehicle's roof is the best location.
2. Thoroughly clean and remove all dust and grit from the surface where the mount is to be placed. Clean the mounting surface each time the antenna is installed.
3. Using the antenna base as a handle, place the edge of the mount on the clean surface area. Slowly lower the mount towards the surface until it snaps into place.
4. Route the antenna cable. For detailed cable routing guidelines, see Routing the cellular antenna cable, page 46.

Caution – Do not slide the mount once it is in place. This can scratch the paint surface.

Mounting the bulkhead cellular antenna

The bulkhead mount 850/1900 MHz cellular antenna (PN 47771) is designed to be permanently mounted on the vehicle.

Figure 2.15 Bulkhead mount 850/1900 MHz cellular antenna (PN 47771)

To install the bulkhead mount 850/1900 cellular antenna:

1. Drill a 19 mm (3/4") hole through the vehicle's metal surface.
2. Carefully remove burrs from the underside of the hole and remove paint in a narrow ring around the hole (see Figure 2.16).

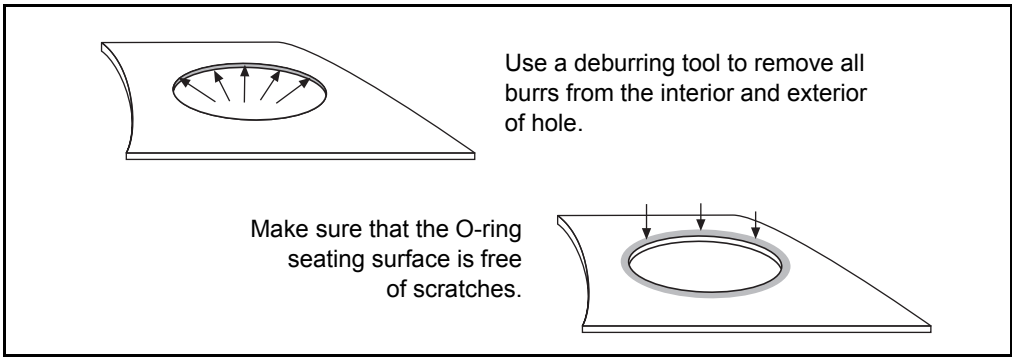

Use a deburring tool to remove all burrs from the interior and exterior of hole.
Make sure that the O-ring seating surface is free of scratches.

Figure 2.16 Removing burrs and inspecting the O-ring seal surface

Note – *Do not scratch the top surface of the hole. The O-ring on the cable mounting assembly must seal to the top surface of the vehicle's metal surface. Scratches may prevent the O-ring from sealing properly and could result in leaks.*

3. Screw the locking nut onto the mounting assembly and twist the nut one and a half times.

4. Feed the coaxial cable and the serrated part of the mounting assembly through the hole (Step 1, Figure 2.17).

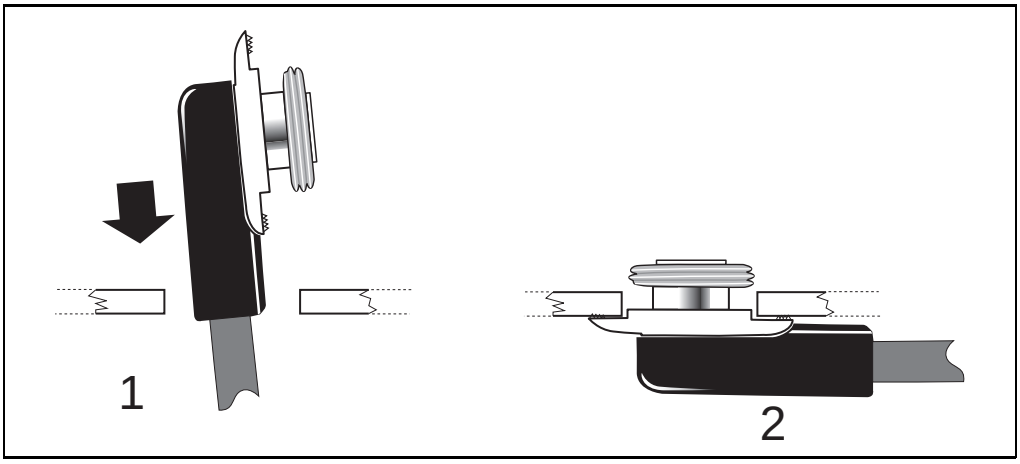


Figure 2.17 Mounting the antenna cable assembly

5. Pull up on the locking nut and slip the mount step into proper alignment in the hole (Step 2, Figure 2.17).
6. Re-install the brass nut from the exterior of the vehicle (Figure 2.18):
    a. Turn the brass nut until the cable mounting assembly is secured in place. The brass nut must make metal-to-metal contact with the vehicle's metal surface to allow the O-ring to seal properly.
    b. Use a wrench (spanner) or long-nose pliers to hold the mounting assembly. Then use an adjustable or open-end wrench to firmly tighten the locking nut.

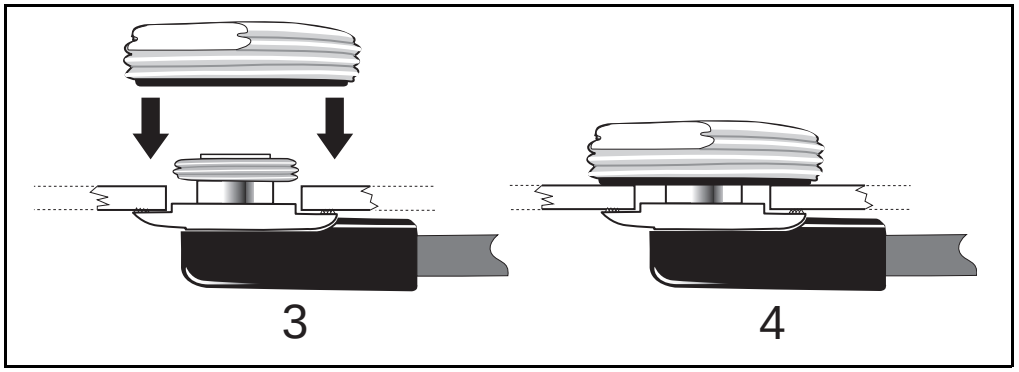


Figure 2.18 Re-installing the brass nut

7. Place the rubber gasket over the brass nut (Step 5, Figure 2.19).

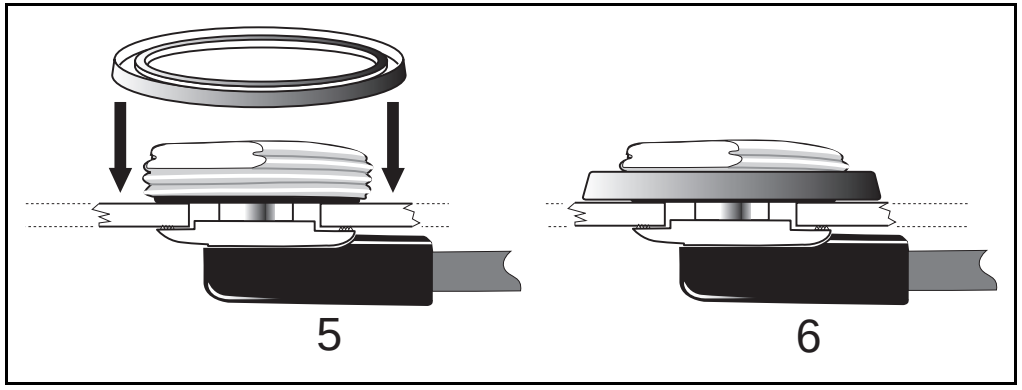


Figure 2.19 Attaching the antenna to the cable assembly

8. Carefully thread the antenna mount onto the brass nut protruding through the top of the metal surface. Turn the antenna mount until the rubber gasket is firmly seated against the vehicle's metal surface.

Figure 2.20 shows the antenna before and after assembly.

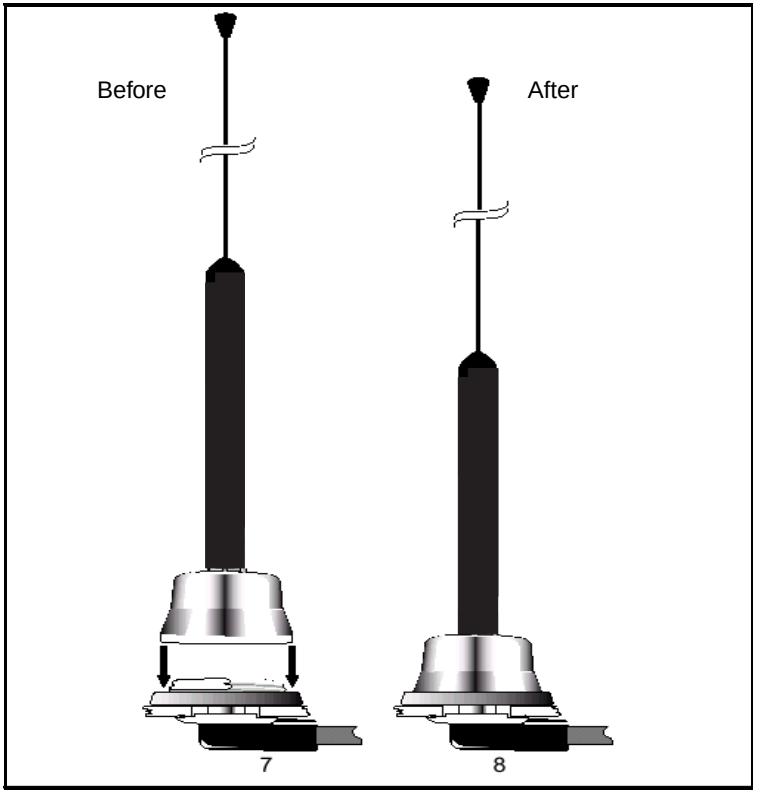
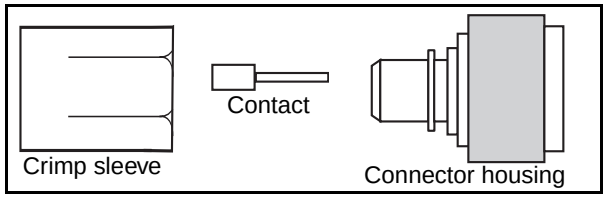
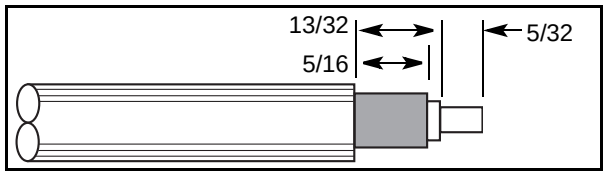
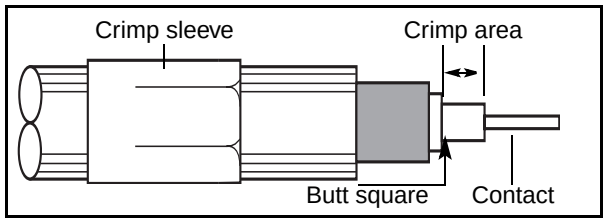
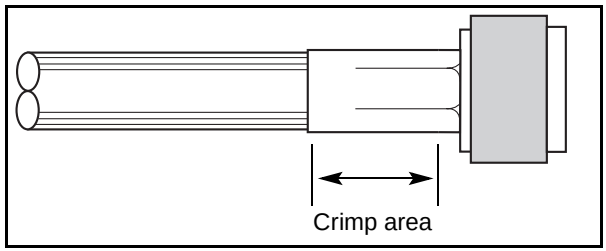


Figure 2.20 Bulkhead mount 850/1900 MHz cellular antenna before and after assembly

9. Route the antenna cable to the CrossCheck GPRS unit. Follow the guidelines provided in Routing the cellular antenna cable, page 46.

10. Cut the antenna cable to remove any excess. Install the TNC connector on the cable end, following the steps in Table 2.2.

Table 2.2 TNC crimp connector assembly instructions

Steps	Illustration
1. Before you begin, make sure that you have the parts as shown opposite.	
2. Trim the cable to the dimensions shown. Make sure that you do not cut the inner conductor or the braid.	
3. Place the crimp sleeve over the cable. Place the inner conductor into the contact. The end of the contact and the inner dielectric must be butting and square. Crimp the cable using a crimp tool.	
4. Flair the outer braid and gently but firmly push the contact into the connector housing until you feel a gentle snap. This indicates that the contact is in place. Slip the crimp sleeve in place, butting the flange against the connector housing, and crimp with a crimp tool.	

Mounting the glass mount 850/1900 MHz cellular antenna

The glass mount 850/1900 MHz cellular antenna (PN 47773) is designed to be permanently mounted on the vehicle's window.

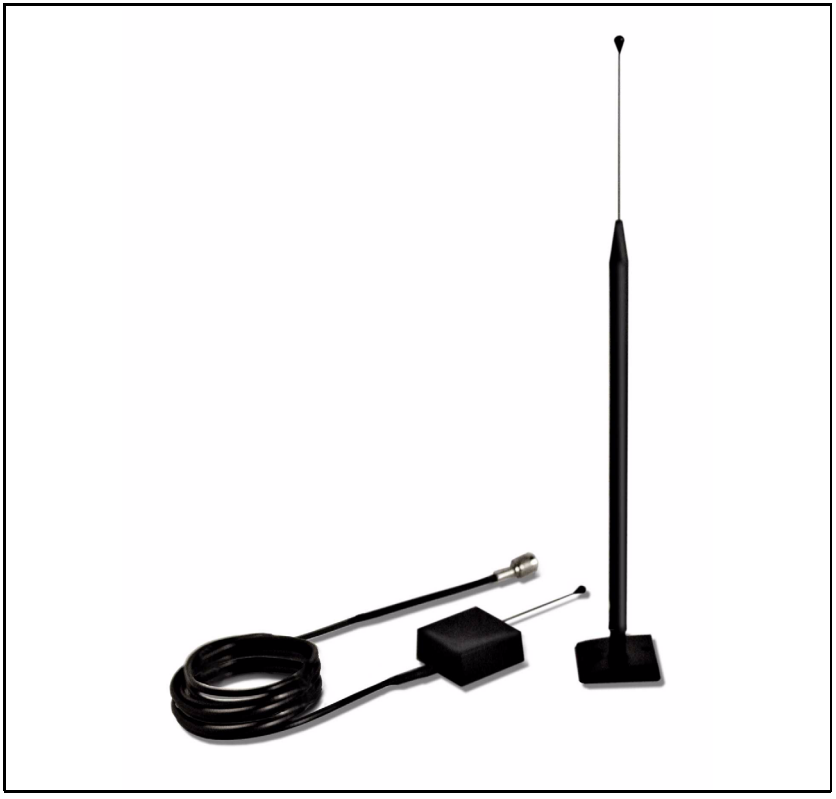


Figure 2.21 Glass mount 850/1900 cellular antenna

To install the glass mount 850/1900 cellular antenna:

1. Select an appropriate location to mount the antenna, preferably in the corner of a rear or side window.

Caution – Do not mount the antenna where it can obstruct the driver's visibility.

Caution – Do not install the antenna:
– on curved glass.
– on glass with metallic content (that is, "solar coat" or "solar cool" passivated glass). Ask the auto manufacturer for details of the glass used in your vehicle.
– on any dark tinted area, or any area where aftermarket tinting film has been applied.
– over an in-glass AM/FM dipole antenna.

Note – *The antenna can be installed over defroster wires if the wires are at least 2.5 cm (1") apart. Center the antenna over one wire so that the wire passes between the horizontal coupling plates (see Figure 2.21).*

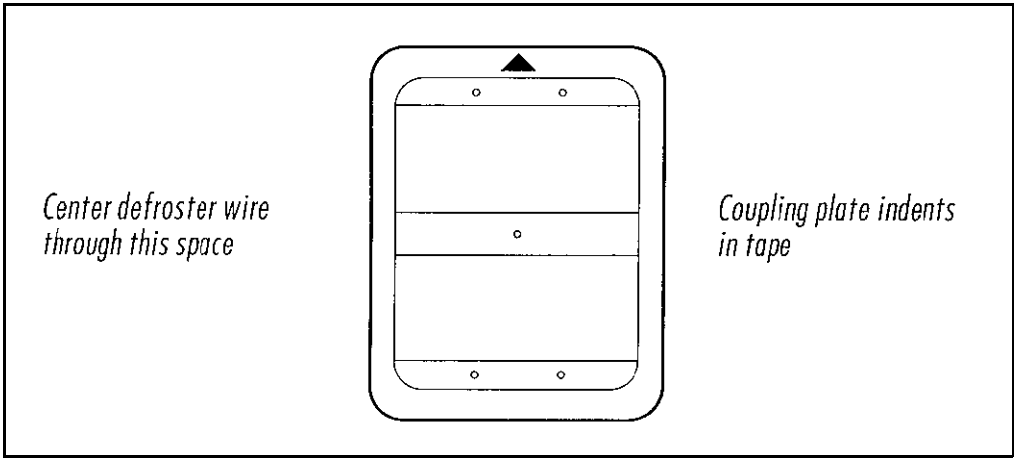


Figure 2.22 Mounting the glass mount antenna over defroster wires

2. Clean both the inside and outside mounting areas with the supplied alcohol pad. Wipe off excess alcohol; do not allow alcohol to dry on the glass. If there is an obvious film on the window, use a mildly abrasive detergent to clean.
3. Prepare the outside mounting area by swabbing with the supplied liquid adhesion enhancer. Allow the enhancer to dry completely, then apply the outside coupler.
4. Peel the protective liner from the adhesive tape on the outside coupler. Mount the outside coupler on the outside of the glass:
    a. With the index arrow pointing upwards, press the top of the outside coupler firmly onto the window. Roll the adhesive surface downwards onto the window, pressing firmly so that the adhesive makes contact.
    b. From the inside of the window, check that the adhesive is making contact at the edges and corners.
    c. Press firmly on all corners and in the center to ensure maximum contact.
    d. If the adhesive is not making contact, apply additional pressure where needed. The seal can be enhanced with a drop of clear silicone sealant.
5. Remove the protective liner from the adhesive tape on the inside coupler. Mount the inside coupler opposite the outside coupler, using the technique described in Step 4.
6. Route the antenna cable to the CrossCheck GPRS unit. Follow the guidelines provided in Routing the cellular antenna cable, page 46.

7. Position the swing arm and whip to the vertical position and tighten cap bolt at the swing arm/coupler connection.

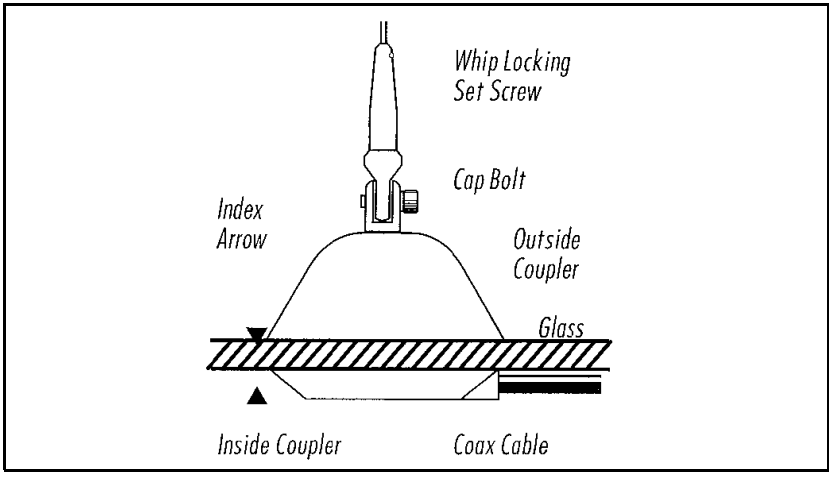


Figure 2.23 Positioning the swing arm

Caution – After installation, do not install whip or expose to water for 24 to 72 hours.

Routing the cellular antenna cable

The next step in the installation process is routing and connecting the antenna cable to the CrossCheck GPRS unit. When routing the cable, start at the antenna and choose the most direct path to the CrossCheck GPRS unit, while avoiding the following hazards:

- Excess coils in the antenna cable, particularly the cellular antenna cable. A coiled cable can act as an antenna and may receive interference.
- Pinching the cable in a hinged door. Provide an adequate service loop when routing the cable around vehicle hinges.
- Vehicle movement that might cause cable damage. Make sure that the coaxial cable is not routed through areas where vehicle movement can abrade the cable surface.
- Exposure to environmental damage. If your cellular antenna cable is exposed to the environment, use tie wraps to secure the cellular antenna cable along its route to prevent wind damage.

Connecting the magnetic cellular antenna cable

The magnetic cellular antenna has a 3.65 m (12 ft) integrated antenna cable with a TNC-plug (TNC-p) connector. After routing and securing the magnetic cellular antenna cable, connect the cable to the TNC connector on the CrossCheck GPRS. Tighten the connector firmly to prevent loosening caused by normal vehicle vibration.

Connecting the bulkhead or glass mount cellular cable

The bulkhead cellular antenna has a 5.1 m (17 ft) integrated cable, and the glass mount cellular antenna has a 4.5 m (15 ft) integrated cable. Neither cable is terminated with a connector. After routing and securing the bulkhead cellular or glass cellular cable, attach the TNC-p connector to the antenna cable. Then attach the cable to the TNC connector on the front panel of the CrossCheck GPRS unit. For instructions on how to install the TNC-p connector, see page 41.

CrossCheck GPRS Power

The CrossCheck GPRS unit operates on input voltages from 9 V DC to 32 V DC. The low-noise amplifier integrated on the GPS antenna draws power from the CrossCheck GPRS unit through the antenna cable. The CrossCheck GPRS unit does not require any special power-up or power-down sequencing.

The CrossCheck GPRS unit's power circuitry protects the unit from random power fluctuations. The unit's input circuits protect it against transient voltage spikes found in most automobile and truck environments. External fuses protect against excessive current.

For more information on the CrossCheck GPRS unit power requirements, see Appendix A, Specifications.

Figure 2.24 shows the power and I/O cable.

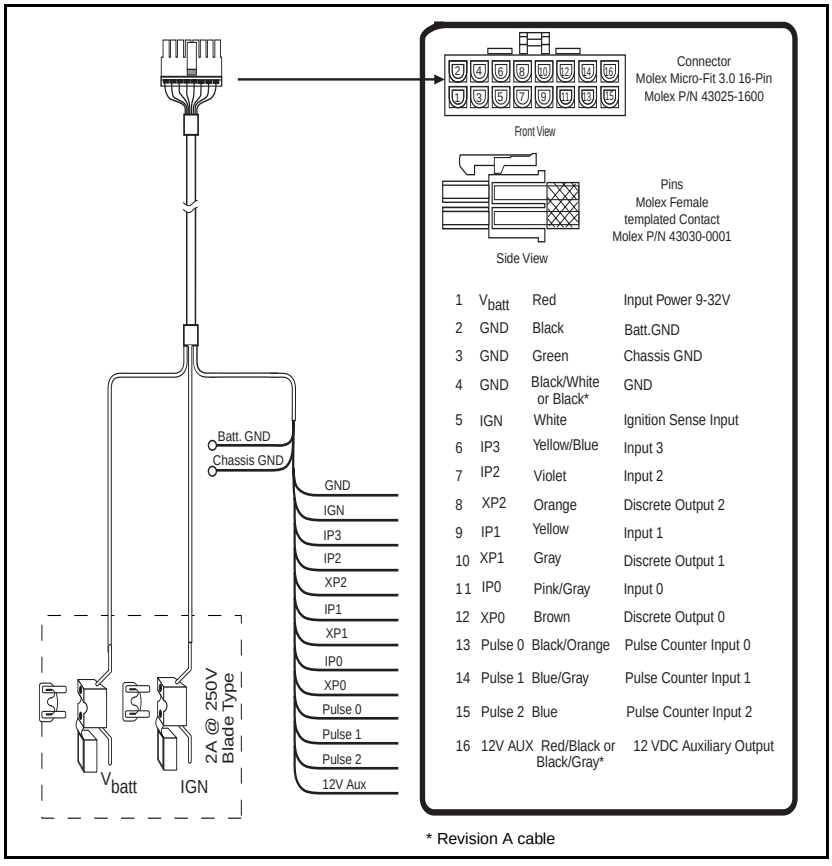


Figure 2.24 Power and I/O cable

Note – *Trimble recommends that you install the power lead as close to the battery as possible. This ensures that the CrossCheck GPRS unit is connected to the cleanest possible source of power.*

Caution – You must install a 2A fuse in the CrossCheck GPRS power cable in the V_{batt} and IGN line. Two 2A fuse and fuse holders are supplied with the power/data cable (P/N 46598). Install the fuse holders and fuses as close as possible to the vehicle battery and ignition switch respectfully.

The DC ground line connects to the vehicle's DC ground. If the ignition-sense lead is connected to a source of ignition-switched battery voltage, it senses when the vehicle's ignition is active. There are two main connection options for connecting the power, ground, and ignition-sense wires:

- Power Management
- Continuous Power

These options are described in the following sections.

Power Management option

When the CrossCheck GPRS unit is connected using the Power Management option, it operates continuously only when the vehicle ignition is on. When the ignition is off, the CrossCheck GPRS unit goes into Sleep mode and draws reduced power. For more information on the current drawn in different operation modes, see Appendix A, Specifications.

By default, when the Power Management option is enabled, the CrossCheck GPRS goes into Sleep mode 15 minutes after it detects that the ignition has been turned off. If the Echo*LDX* is connected to the CrossCheck, the Echo*LDX* turns off one minute after the CrossCheck detects that the ignition has been turned off.

Figure 2.25 shows the connections for the Power Management option.

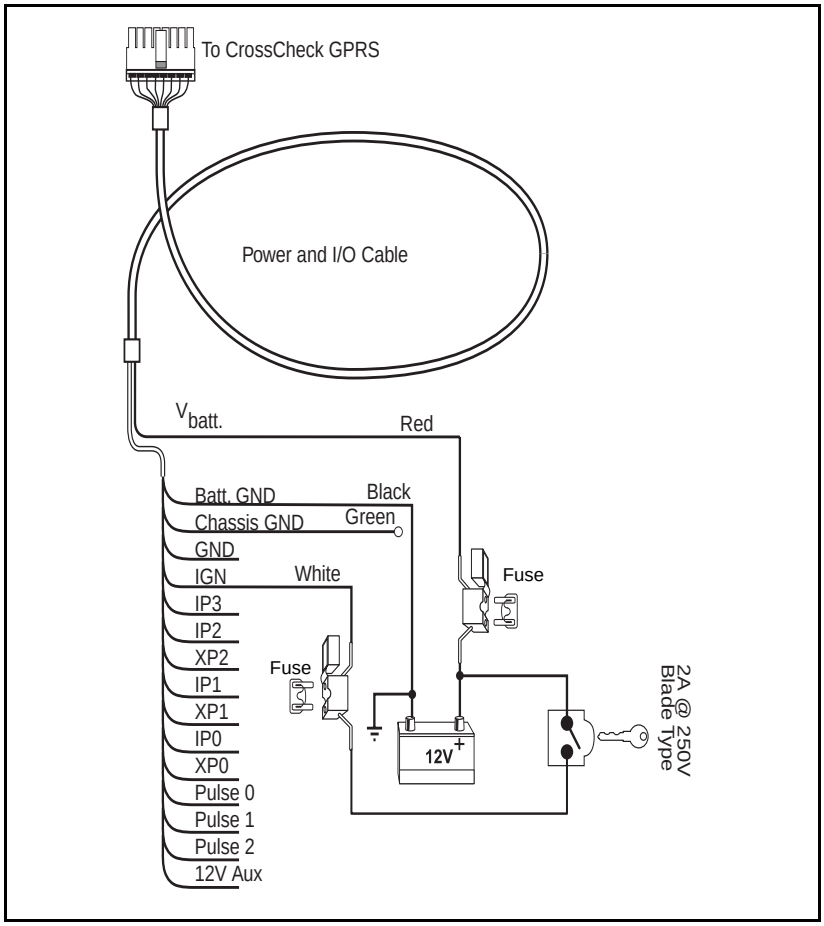


Figure 2.25 Power Management connections

To install the power cable for the Power Management option:

1. Connect the primary power line to a non-switched or continuous source of DC power, such as the vehicle's battery.
2. Connect the ignition-sense line to ignition-switched battery power, so that this line is active when the ignition is on.

Continuous Power option

When the CrossCheck GPRS unit is connected using the Continuous Power option, it draws power continuously, even when the vehicle is not running. Typical power consumption in idle mode (when the unit is not transmitting) at 12 V DC is 90 mA without the Echo*LDX* terminal, and 160 mA with the Echo*LDX* terminal.

Caution – When connected to the vehicle's battery using the Continuous Power option, the CrossCheck GPRS unit may drain the battery if the vehicle is not running for several days. The time to drain the battery is 1 to 3 weeks, depending on the battery size, quality, and remaining life span. If the CrossCheck GPRS unit is connected using the Continuous Power option, it can also drain the battery of a vehicle that is not running long enough to compensate for the current draw of the CrossCheck. **Observe extreme care when using this connection option**. The CrossCheck GPRS unit will automatically power off when the voltage drops below 9 V DC.

Figure 2.26 shows the connections for the Continuous Power option.

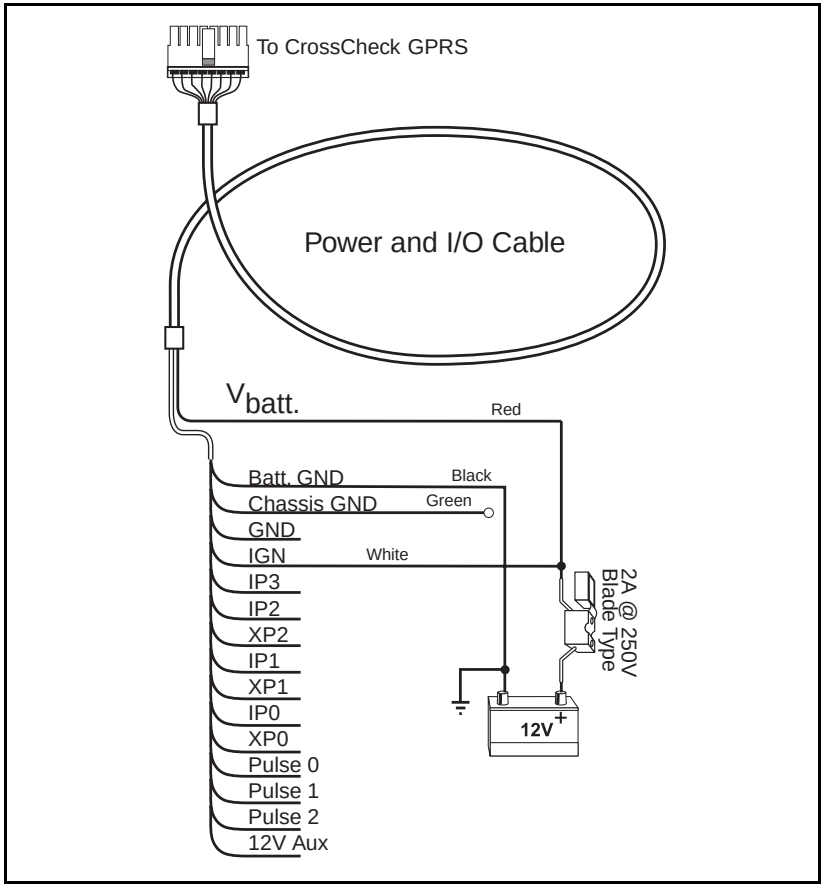


Figure 2.26 Continuous Power connections

To connect the power cable for the Continuous Power option:

1. Connect the primary power line to a non-switched or continuous source of DC power, such as the vehicle's battery.
2. Connect the ignition-sense line to a non-switched or continuous source of DC power, such as the vehicle's battery.

Other Connections

The flexible power and I/O cable (PN 46598) connects a variety of input and output peripherals to the CrossCheck GPRS unit. See Figure 2.27.

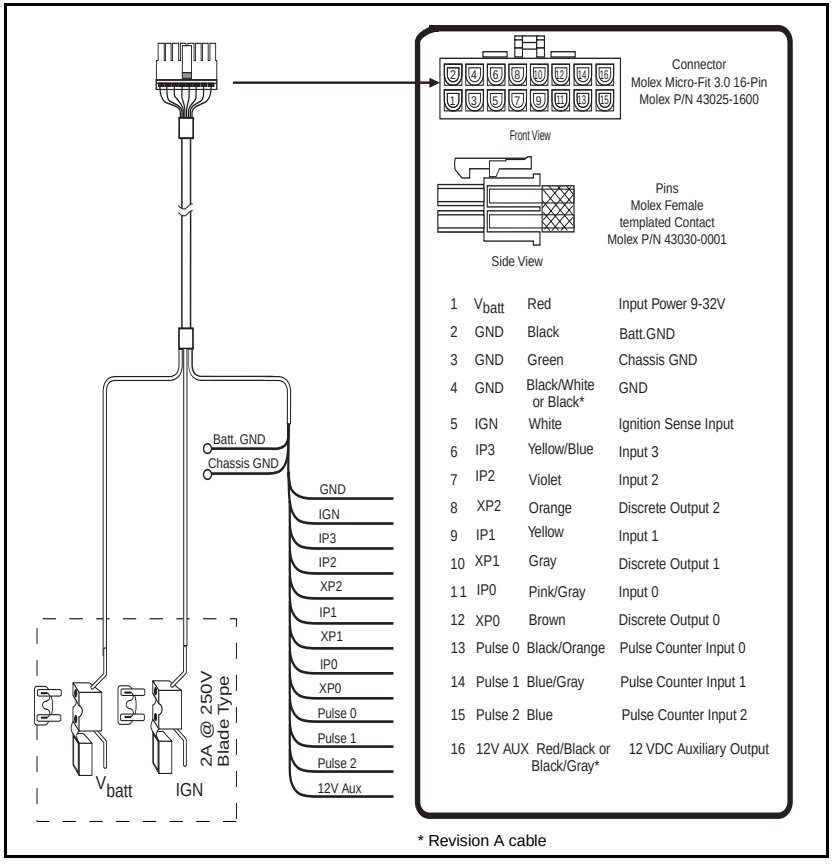


Figure 2.27 Power and I/O cable

The power and I/O cable includes 16 wires (20 AWG). The input power wire (red) and the ignition sense input wire (white) are 4.87 meters (16 ft) long. Each of the remaining 14 wires is 91 cm (3 ft) long.

Table 2.3 provides pinout information for the power and I/O cable.

Table 2.3 Power and I/O cable pinout

Pin	Signal	Color	Termination	Length (")
1	V_{batt}	Red	Cut Flush	192
2	BAT GND	Black	Ring Lug	36
3	CHAS GND	Green	Ring Lug	36
4	GND	Black/White (or Black[1])	Cut Flush	36
5	IGN	White	Cut Flush	192
6	IP3	Yellow/Blue	Cut Flush	36
7	IP2	Violet	Cut Flush	36
8	XP2	Orange	Cut Flush	36
9	IP1	Yellow	Cut Flush	36
10	XP1	Gray	Cut Flush	36
11	IP0	Pink/Gray	Cut Flush	36
12	XP0	Brown	Cut Flush	36
13	PULSE 0	Black/Orange	Cut Flush	36
14	PULSE 1	Blue/Gray	Cut Flush	36
15	PULSE 2	Blue	Cut Flush	36
16	12 V AUX	Red/Black (or Black/Gray[1])	Cut Flush	36

[1]Revision A cable.

Inputs (IP0 to IP3)

The CrossCheck GPRS unit supports four discrete inputs. Figure 2.28 shows the circuit diagram.

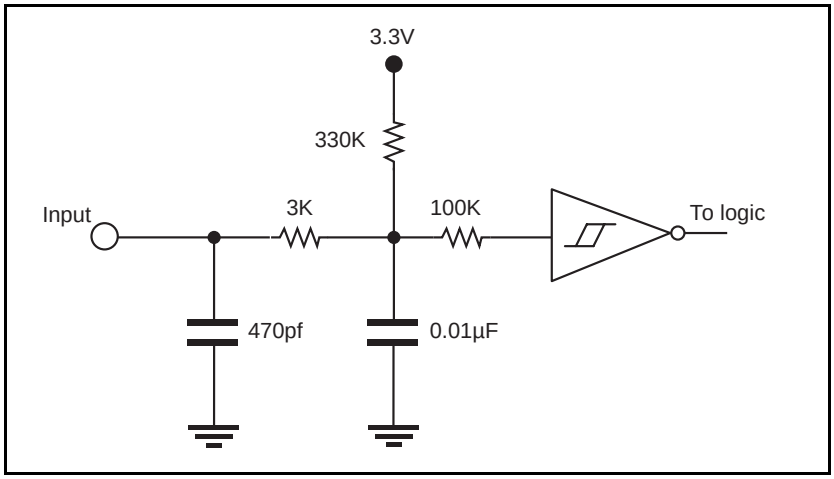


Figure 2.28 Input circuit diagram

For input specifications, see Table A.16 on page 76.

Each input floats to a logic-high state (inactive) when left open. Grounding an input causes a logic-low state (active). The CrossCheck GPRS unit can be configured to detect either logic-high or logic-low states at the inputs whenever the unit is switched on.

Note – *When the CrossCheck GPRS unit is switched off or in Sleep mode, it can only detect a logic-low (grounded) input.*

The internal input circuitry incorporates a resistor-capacitor network on the input. This filters noise to avoid triggering on very short pulses. The discrete inputs are compatible with properly connected relays and switches, and with standard 3.3 V DC logic levels. A properly connected relay or switch allows the input to float high in one position and grounds the input in the other position.

Pulse-counting inputs (Pulse 0 to Pulse 2)

The CrossCheck GPRS unit also supports three pulse-counting inputs that can be used to support external sensors for other applications (for example, a speed sensor). Figure 2.29 shows the circuit diagram.

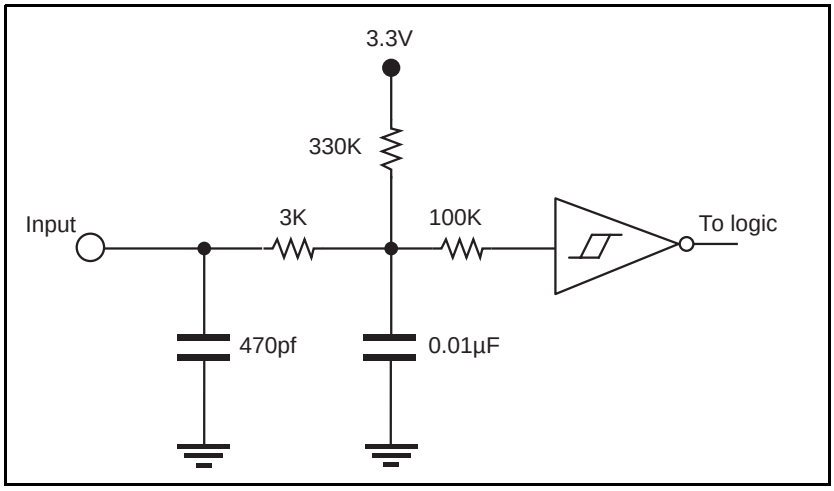


Figure 2.29 Pulse-counting input circuit diagram

For input specifications, see Table A.17 on page 76.

Outputs (XP0 to XP2)

The CrossCheck GPRS unit features three discrete outputs (XP0–XP2) for driving external devices such as relays and alarms.

- In the inactive (use) state, the discrete outputs are tied to vehicle battery voltage (nominally 12 V DC) through a 15 KOhm resistor.
- In the active (low) state, the discrete outputs are shorted to ground through a bipolar junction transistor. In the active state, the outputs can sink up to 200 mA.

Figure 2.30 shows a diagram of a discrete output.

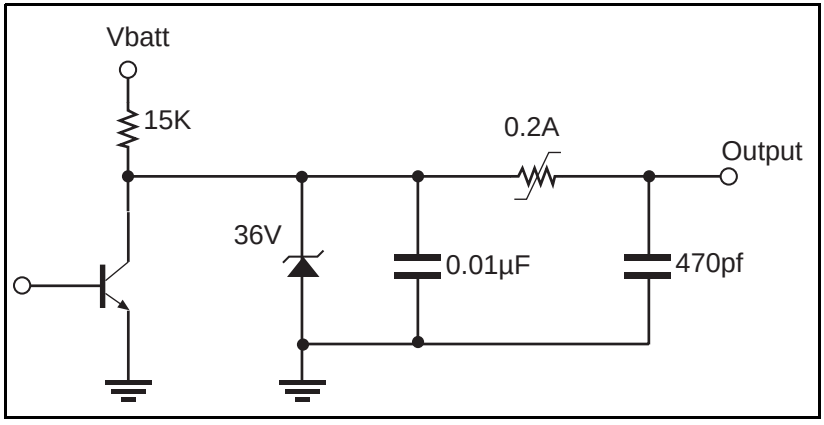


Figure 2.30 Output circuit diagram

For output specifications, see Table A.18 on page 77.

Message Terminal Port (DB9 receptacle)

The Message Terminal Port is a serial RS-232 port for messaging communication with the optional Echo*LDX* Message Terminal Kit (P/N 46722-00).

Note – *This port can also be used for data pass-through communications. For more information, contact your Trimble representative.*

The Echo*LDX* Message Terminal Kit is available as an optional system component. It provides the vehicle operator with a quick and easy method to display, store, and reply to text and dispatch messages without voice communication.

Figure 2.31 shows the cable connections between the Echo*LDX* terminal and the CrossCheck GPRS unit.

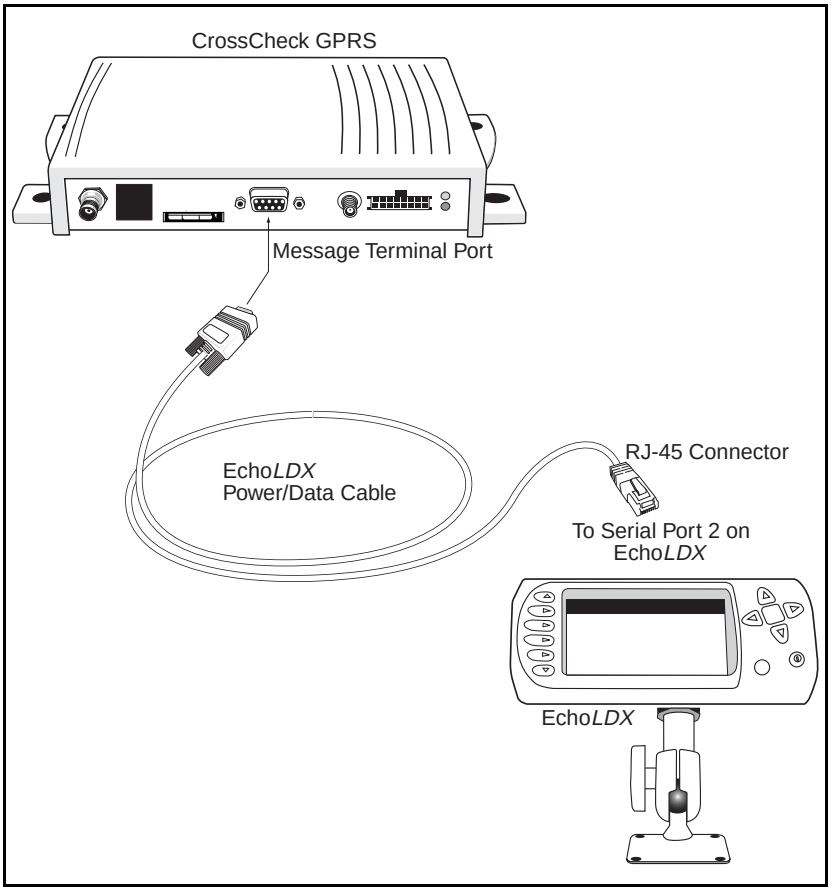


Figure 2.31 Echo*LDX* terminal to CrossCheck GPRS connections

CHAPTER

3

Operation

In this chapter:

- Introduction
- LED Indicators
- GPS Receiver Operation
- Registration

Introduction

Once you have installed and configured the CrossCheck GPRS unit, it is ready for operation. When power is applied, the CrossCheck GPRS unit operates automatically without user intervention.

This chapter provides a basic overview of how the CrossCheck GPRS unit operates.

LED Indicators

The CrossCheck GPRS unit has two LED indicators, as shown in Figure 3.1. These LEDs provide feedback on the status of the integrated GPS receiver and GPRS cellular transceiver, which the CrossCheck GPRS unit firmware monitors continuously.

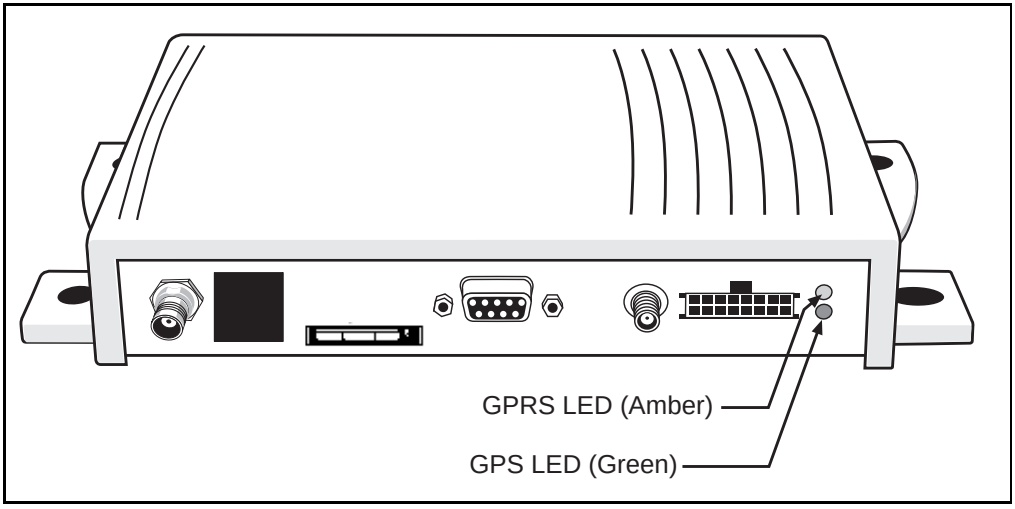


Figure 3.1 LED indicators

The GPS and GPRS LED indicators have three states: on, off, and flash. When both indicators are off, the CrossCheck GPRS unit's power is off. When one or both LED indicators are on or flashing, the power is on.

LED states

Table 3.1 identifies the GPS LED states.

Table 3.1 GPS (green) LED states

State	Meaning
On	Computing GPS position fixes.
Flash	Searching, or not computing GPS position fixes.
Off	No power is available, or the ignition is off.

Table 3.2 identifies the GPRS LED states.

Table 3.2 GPRS (amber) LED states

State	Meaning
On	GPRS coverage is available and the CrossCheck GPRS unit is registered with the appropriate GPRS network.
Slow flash	The first three minutes after power up, indicates that the unit is searching for a GPRS network. If the LED continues to flash, it either means that there no GPRS coverage is available, or the CrossCheck GPRS unit is not registered with the local network.
Fast flash	SIM card is not inserted correctly, is missing, or it is protected by a PIN.
Off	No power is available, or the ignition is off.

LED power-on sequence

When the CrossCheck GPRS unit's ignition and power inputs are activated:

- The GPS LED flashes once, turns off for approximately five seconds, then turns on for approximately two seconds, flashes until the ***first*** position ***fix*** is computed, then stays on.

- The GPRS LED flashes once, turns off for approximately five seconds, flashes until the unit is registered with a GPRS network, then stays on.

GPS Receiver Operation

When the CrossCheck GPRS unit is powered on, the GPS receiver initializes with the last known position if one is available. Using this information, the GPS receiver acquires satellite signals.

During the satellite acquisition process—which normally takes less than 45 seconds—the green GPS LED flashes. Once a sufficient number of satellites have been acquired, the GPS receiver computes positions, course, and speed, and the green GPS LED stays on.

When the GPS LED is flashing, it indicates that the GPS receiver is not tracking enough satellites to calculate a current position. This occurs occasionally when the vehicle is obscured from satellite signals by terrain, buildings, trees, tunnels, or other structures. During this period, called *satellite reacquisition*, the GPS receiver continuously searches for the obscured satellites and expands its search to other satellites to continue position computations. For brief blockages, the GPS receiver normally reacquires a lost satellite signal and resumes position fixes in less than two seconds.

Note – *If the CrossCheck GPRS unit does not have a valid last known position, the unit performs a cold start. A cold start normally takes less than three minutes. This happens the first time the unit is turned on, or if the unit has never been on long enough to obtain a complete almanac. To obtain an initial almanac, the unit must track GPS satellites for up to 30 minutes.*

Registration

When the CrossCheck GPRS unit is turned on, it checks whether a SIM card is installed. If a SIM card is not detected or has not been installed properly, the amber LED flashes rapidly. If a SIM card is installed, the unit tries to register with the appropriate GPRS network. If the unit cannot detect a GPRS network, the amber GPRS LED flashes slowly.

Once the CrossCheck detects a GPRS network, it begins the registration process to get a dynamic IP (Internet Protocol) address from the GPRS network provider. This IP address is used for the CrossCheck GPRS unit until it is turned off.

When the CrossCheck GPRS unit has successfully registered with the network, the amber GPRS LED stays on. The CrossCheck GPRS unit then establishes communication with the Telvisant platform, indicating its new IP address and location (if available). If the Echo*LDX* messaging terminal is installed, an antenna symbol appears in the left corner of the Echo*LDX* display whenever the CrossCheck GPRS unit is connected to the Telvisant Wireless Gateway.

When the vehicle is stopped or parked and the ignition is turned off, the CrossCheck GPRS unit remains connected to the network for a specific period. After that period the unit disconnects from the GPRS network and turns itself off. When it is turned on again, the unit establishes a new GPRS connection.

Occasionally the vehicle may enter an area that does not have GPRS coverage. If the CrossCheck GPRS unit is connected to a GPRS network when this happens, the amber GPRS LED flashes slowly. When the unit returns to an area with GPS coverage, it establishes a new GPRS connection.

APPENDIX

A

Specifications

In this appendix:

- Introduction
- Standard Components
- Environmental Specifications
- I/O Characteristics
- Accessories
- CrossCheck GPRS Part Numbers

Introduction

This appendix lists specifications for the CrossCheck GPRS unit and antennas.

Standard Components

The tables in this section include general specifications and requirements for the CrossCheck GPRS unit.

Table	Specification	Page
Table A.1	General specifications	page 67
Table A.2	Firmware specifications	page 68
Table A.3	Physical specifications	page 68
Table A.4	GPS specifications	page 69
Table A.5	GPS antenna requirements	page 69
Table A.6	GPRS communications specifications	page 70
Table A.7	Cellular antenna requirements for GSM 1900 PCS	page 70

Table A.1 General specifications

Item		Specification
Input voltage		9.0 to 32.0 V DC
Current Consumption (typical)	Transmitting	with Echo*LDX*: 340 mA (1.6 A peak) at 12 V DC without Echo*LDX*: 270 mA (1.5 A peak) at 12 V DC
	Not transmitting	with Echo*LDX*: 160 mA at 12 V DC without Echo*LDX*: 90 mA at 12 V DC
	Sleep mode	< 10 mA at 12 V DC
Message Terminal port		(1) RS-232 DCE
Serial port speed (bps)		9600
Inputs and outputs	Discrete inputs	(4) switch closures to ground; internal pull-up
	Ignition sense	Off: < 0.5 VDC or open (internal pull down) On: > 2.5 VDC up to Vbatt
	Pulse counting inputs	(3) minimum pulse width: 500 microseconds
	Discrete outputs	(3) 200 mA low-side drivers
Sensor power output		(1) 100 mA max at 11.5 V ±1.0 V DC
Status LEDs		GPS (green) and GPRS (amber)

Table A.2 Firmware specifications

Item	Specification
Configurable parameters (OTA)	Geo-fence area for Job Sites
	Geo-fence area for Home Sites
	Entry speed limit for site dispatch
	Exit speed limit for site dispatch
	Site dispatch time-out
	Minimum duration to detect entry/exit regions
	Automatic status reporting for Ready Mix applications (only available on the CrossCheck GPRS Ready Mix version)
Speeding reports	Enable speed and duration thresholds
Stop reports	Enable speed and duration thresholds
Mileage/run time	Set the initial odometer value and engine run time counter
	Support datalogging that allows the CrossCheck GPRS unit to store messages and events for up to 1 week while out of the network coverage area.
Messaging	Available through Echo*LDX* Message Terminal

Table A.3 Physical specifications

Item		Specification
Assembly	Top	Injection-molded plastic with integrated shield
	Bottom	Aluminum
Size		228 mm W × 121 mm D × 36 mm H (8.97" W × 4.76" D × 1.42" H)
Weight		485 g (1 lb 1.1 oz.)
Connectors	Message Terminal	DB9 (receptacle)
	Power/ignition + digital I/O	Molex Micro-Fit 3.0 16-pin 2-row locking (plug)
	GPS antenna	SMA (receptacle) 50 Ω
	GPRS antenna	TNC (receptacle) 50 Ω

Table A.4 GPS specifications

Item		Specification
Receiver		L1 frequency, C/A code (SPS), 8-channel continuous tracking receiver using the Trimble FirstGPS™ and Colossus™ technology
Update rate		Once per second maximum
Accuracy without S/A[1]	Position	< 10 meters (50% CEP)
	Velocity	< 0.5 meters/second
First acquisition	Cold start	< 180 seconds in 90% of cases
	Warm start	< 45 seconds in 90% of cases
	Reacquisition after 15 seconds of blockage	< 2 seconds in 90% of cases
Datum		WGS-84
Reacquisition after signal loss		< 2 seconds in 90% of cases

[1]All GPS receivers are subject to degradation of position and velocity accuracies under Department of Defense imposed Selective Availability (S/A). S/A was turned off in May 2000.

Table A.5 GPS antenna requirements

Item	Specification
Antenna impedance	50 Ω
Antenna RF gain	20 dBi minimum gain, measured at the input connector of the CrossCheck GPRS
Noise figure	2.5 dB maximum, measured at the input connector of the CrossCheck GPRS
VSWR	2:1 maximum over range
Power	5.0 ±0.5 V DC @ 40 mA maximum on center conductor

Table A.6 GPRS communications specifications

Item	Specification
Cellular	Internal GPRS module Class B Time slots 2 Rx, 1 Tx 2W @ 900 MHz, 1W @ 1900 MHz
Frequencies	Dual band 900/1900 MHz
SIM	3 V DC
Regulatory approvals	Complies with the European Telecommunications Standards Institute specifications ETS 301 489-1; CE MARK; EC R&TTE Type Examination, FCC Part 15, FCC Part 24, Low Voltage Directive (EN60950), e-mark, PTCRB, and Industry Canada RSS 133 requirements.

Table A.7 Cellular antenna requirements for GSM 1900 PCS

Item		Specification
Antenna type		For the CrossCheck GPRS unit: Passive, 1900 or 900/1900 MHz nominal, omnidirectional
Antenna impedance		50 Ω (nominal)
VSWR		2:1 maximum over entire frequency range
Gain (including cable loss)	Minimum	0 dBi
	Maximum	3 dBi
Frequency	Tx	1850 MHz to 1910 MHz GPRS 1900
	Rx	1930 MHz to 1990 MHz GPRS 1900

Caution – To satisfy the FCC RF exposure requirements, a minimum separation distance of 20 cm must be maintained between the antenna and the operator. The maximum antenna gain, including any cable loss, must not exceed 3dBi. If the antenna is installed close to another antenna, then the requirements of Section 1.1307 (b) (3) of the FCC rules (antenna co-location) must be satisfied.

Environmental Specifications

The tables in this section list environmental specifications for the CrossCheck GPRS and the GPS antennas.

Table	Specification	Page
Table A.8	Environmental specifications for CrossCheck GPRS 1900 mobile unit	page 71
Table A.9	Environmental specifications for miniature bulkhead mount GPS antenna with flange (PN 31192-00)	page 72
Table A.10	Environmental specifications for miniature bulkhead mount GPS antenna without flange (PN 32434)	page 72
Table A.11	Environmental specifications for miniature magnetic mount GPS antenna (PN 37167)	page 73

Table A.8 Environmental specifications for CrossCheck GPRS 1900 mobile unit

Item		Specification	
Operating temperature		–20 °C to +55 °C (–4 °F to 131 °F) for 900 –10 °C to +55 °C (–14 °F to 131 °F) for 1900	
Storage (non-operating) temperature		–40 °C to +85 °C (–40 °F to 185 °F)	
Humidity		5% to 95% RH, non-condensing at +40 °C	
Velocity		450 meters/second	
Vibration		$0.008g^2$/Hz	5 Hz
		+3dB/Octave	5 Hz to 20 Hz
		$0.05g^2$/Hz	20 Hz to 100 Hz
		–3dB/Octave	100 Hz to 800 Hz
		$0.001g^2$/Hz	800 Hz to 1000 Hz
Shock	Operational	40 g for 11 milliseconds	
	Non-operational	75 g for 6 milliseconds	
MTBF		100,000 hours	

Table A.9 Environmental specifications for miniature bulkhead mount GPS antenna with flange (PN 31192-00)

Item	Specification
Size	62.6 mm D × 19.0 mm H (3.5" D × 0.75" H)
Weight	0.13 kg (4.59 oz)
Mounting hole circle	76.2 mm (3.0"), 4 holes, 3.1 mm (5/32")
Center mounting hole	19 mm (0.75")
Threaded nut	19 mm (0.75")
Operating temperature	–40 °C to +85 °C (–40 °F to 185 °F)
Storage temperature	–55 °C to +85 °C (–67 °F to 185 °F)
Humidity	5% to 95% RH, non-condensing at +40 °C (104 °F)
Casing	Dustproof, waterproof, shock-resistant polycarbonate
Minimum gain	28 dBi
Maximum allowable cable loss	8 dB

Table A.10 Environmental specifications for miniature bulkhead mount GPS antenna without flange (PN 32434)

Item	Specification
Size	62.6 mm D × 19.0 mm H (3.5" D × 0.75" H)
Weight	0.13 kg (4.59 oz)
Center mounting hole	19 mm (0.75")
Threaded nut	19 mm (0.75")
Operating temperature	–40 °C to +85 °C (–40 °F to 185 °F)
Storage temperature	–55 °C to +85 °C (–67 °F to 185 °F)
Humidity	5% to 95% RH, non-condensing at +40 °C (104 °F)
Casing	Dustproof, waterproof, shock-resistant polycarbonate
Minimum gain	28 dBi
Maximum allowable cable loss	8 dB

Table A.11 Environmental specifications for miniature magnetic mount GPS antenna (PN 37167)

Item		Specification
Size		40.0 mm W × 47.0 mm D × 13.3 mm H (1.515" W × 1.85" D × 0.524" H)
Weight	Antenna and cable	0.13 kg (4.59 oz)
	Antenna only	0.045 kg (1.59 oz)
Operating temperature		–40 °C to +85 °C (–40 °F to 185 °F)
Storage temperature		–55 °C to +85 °C (–67 °F to 185 °F)
Humidity		5% to 95% RH
Casing		Dustproof, waterproof, shock-resistant polycarbonate with magnetic mount
Minimum gain		26 dBi

Table A.12 Environmental specifications for magnetic mount 850/1900 cellular antenna (PN 46764)

Item		Specification
Frequency		825–896 / 1850–1990 MHz
Gain	Cellular	3 dBd/5.2 dBi (1.5 dBd/3.7 dBi including cable loss)
	PCS	3 dBd/5.2 dBi (0.7 dBd/2.9 dBi including cable loss)
Type	Cellular	Collinear
	PCS	5/8 over 5/8 over 1/2 wave
VSWR (see bandwidth)		2.0:1 or less
Power rating		7 W
Color		Black
Cable type		Coaxial RG-58/U dual shield
Cable length		3.65 m (12 ft)
Base size		76 mm (3")
Maximum height		330 mm (13")

Table A.13 Environmental specifications for bulkhead mount 850/1900 cellular antenna (PN 47771)

Item		Specification
Frequency		825–896 / 1850–1990 MHz
Gain	Cellular	3 dBd/5.2 dBi (1.5 dBd/3.7 dBi including cable loss)
	PCS	3 dBd/5.2 dBi (0.7 dBd/2.9 dBi including cable loss)
Type	Cellular	Collinear
	PCS	5/8 over 5/8 over 1/2 wave
VSWR (see bandwidth)		1.5:1 or less
Power rating		100 W
Color		Black
Cable type		Coaxial RG-58/U dual shield
Cable length		5.18 m (17 ft)
Maximum height		355 mm (14") max
Mounting		19 mm (3/4") roof mount

Table A.14 Environmental specifications for glass mount 850/1900 cellular antenna (PN 47773)

Item		Specification
Frequency		825–896 / 1850–1990 MHz
Gain	Cellular	3 dBd/5.2 dBi (1.5 dBd/3.7 dBi including cable loss)
	PCS	3 dBd/5.2 dBi (0.7 dBd/2.9 dBi including cable loss)
Type	Cellular	Collinear
	PCS	5/8 over 5/8 over 1/2 wave
VSWR (see bandwidth)		2.0:1 or less
Power rating		100 W
Color		Black
Cable type		Coaxial RG-58/U dual shield
Cable length		4.057 m (15 ft)
Base size		44.45 mm × 48.26 mm (1.75" × 1.9")
Maximum height		355.6 mm (14")

I/O Characteristics

The tables in this section list I/O characteristics of the CrossCheck GPRS.

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Table A.16	Discrete inputs: IP0 to IP3	page 76
Table A.17	Pulse counter inputs	page 76
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Table A.15 Message Terminal port

Item		Specification
Physical		DB9 (receptacle)
Logical		TXD, RXD, RTS, CTS, GND, DTR, DCD, DTS, 11.5 ±1 V DC provided through Pin 9
Communication parameters	Baud rate	9600
	Parity	None
	Data bits	7
	Stop bits	1

Table A.16 Discrete inputs: IP0 to IP3

Item	Specification
Input logic high	Open circuit or V_{in} > 2.5 V DC
Input logic low	V_{in} < 0.4 V DC or 10KOhm 1/4 Watt resistor to Ground The inputs must remain in either state for at least 500 milliseconds before the CrossCheck GPRS unit detects the input.
Input current	Iin ± 1 mA at 12 VDC
Input protection	Protected up to at least V_{batt} continuous

Table A.17 Pulse counter inputs

Item	Specification
Input logic high	Open circuit or V_{in} > 2.5 V DC
Input logic low	V_{in} < 0.4 V DC The inputs must remain in either state for at least 500 milliseconds before the CrossCheck GPRS unit detects the input.
Input current	I_{in} ± 1 mA at 12 VDC
Minimum pulse width	500 µs
Input protection	Protected up to at least V_{batt} continuous

Table A.18 Discrete outputs: XP0 to XP2

Item	Specification
Output inactive	15 KΩ tied to V_{batt} ***Caution –*** *Short circuits to V_{batt} must be avoided as they can cause damage to the unit.*
Output active	Tied to ground through a saturated bipolar junction transistor, V_{out} < 1.5 V DC @ 200 mA; V_{out} < 0.5 V DC @ 10 mA
Output sink current capability	Up to 200 mA
Output protection	Protected against shorts to ground

Accessories

The following accessories can be ordered separately:

- Permanent or magnetic mount GPS antennas
- Power and digital I/O cable, with or without cigarette lighter adaptor
- Optional Echo*LDX* Message Terminal Kit, including:
  - Echo*LDX* Mobile Data Terminal
  - Power/data cable
  - Pedestal mount Kit (6")
  - Echo*LDX Message Terminal Installation and User's Manual* (available for free download in PDF format from the Trimble website at www.trimble.com/support.html)
  - Echo*LDX Quick Reference Guide*

CrossCheck GPRS Part Numbers

Part numbers for the CrossCheck GPRS unit, options, and accessories are listed in Table A.19.

Table A.19 Component part numbers

Description	Part number
Kits	
CrossCheck GPRS 1900 Mobile Unit Demo Kit: GPS magnetic mount antenna GPRS magnetic mount antenna Power and I/O cable with cigarette lighter adaptor Echo*LDX* Message Terminal Kit	46728-01
CrossCheck GPRS 1900 Mobile Unit[1]	46728-11
CrossCheck GPRS 1900 Ready Mix Mobile Unit[1]	46728-12
CrossCheck GPRS 1900 Heavy Vehicle Mobile Unit[1]	46728-13
Upgrade kits	
Echo*LDX* Message Terminal Kit	46722-00
GPS antenna and cable bundles	
GPS antenna bundle (flange, straight cable): 31192-00 Mini bulkhead mount antenna, TNC-p, gasket, 5-hole flange 36107 Cable, straight, TNC-r to straight SMA-p, 5 meter	36697-00
GPS antenna bundle (flange, right-angle cable): 31192-00 Mini bulkhead mount antenna, TNC-p, gasket, 5-hole flange 36106 Cable, right angle, TNC-r to right angle SMA-p, 5 meter	36698-00
GPS antenna bundle (no flange, straight cable): 32434 Mini bulkhead mount antenna, TNC-p, gasket, no flange 36107 Cable, straight, TNC-r to straight SMA-p, 5 meter	36699-00
GPS antenna bundle (no flange, right-angle cable): 32434 Mini bulkhead mount antenna, TNC-p, gasket, no flange 36106 Cable, right angle, TNC-r to right angle SMA-p, 5 meter	36700-00

Table A.19 Component part numbers (Continued)

Description	Part number
GPS antennas and cables – separate	
Mini bulkhead mount antenna, TNC-p, gasket, 5-hole flange	31192-00
Mini bulkhead mount antenna, TNC-p, gasket, no flange	32434
Cable, right angle, TNC-r to straight SMA-p, 5 meter	36106
Cable, straight, TNC-r to straight SMA-p, 5 meter	36107
Right angle adaptor, SMA-p to SMA-r	36200
Mini magnetic mount antenna with 5-meter cable, SMA-p	37167
GPRS cellular antennas	
Magnetic mount 850/1900 cellular antenna	46764
Bulkhead mount 850/1900 cellular antenna	47771
Glass mount 850/1900 cellular antenna	47773
Cables and accessories	
Power and I/O cable – single	46598
Echo*LDX* power/data cable, 2.90 meter	46755
EchoLDX Quick Reference Guide	46845-00-ENG
Pedestal mounting kit (6")	46950
Documentation	
CrossCheck GPRS unit 1900 Installation Manual[2]	47770-00-ENG
Echo*LDX Message Terminal Installation and User's Manual*[2]	46667-00-ENG

[1]Does not include GPS antenna, GPRS antenna, or power and I/O cable (PN 46598). These components must be ordered separately.

[2]Available in electronic PDF format only, downloadable for free from the Trimble website at www.trimble.com/support.html.

Note – *The part number of the CrossCheck GPRS unit depends on the carrier and coverage for certain areas. To order the correct part number for your area, contact your Trimble representative.*